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THE U.S. ARMY RESEARCH & DEVELOPMENT PROGRAM  
in  
CHEMICAL, BIOLOGICAL and RADIOLOGICAL  
WARFARE

for  
fiscal year 1959

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CBR Warfare,  
FY 1959

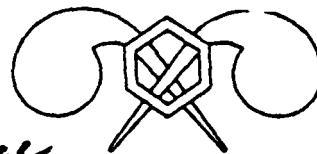
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Dated 8/6/87, 1/11/88

Carl Wilson 2/16/88



prepared by U.S. ARMY CHEMICAL CORPS  
RESEARCH & DEVELOPMENT COMMAND

WASHINGTON 25, D.C.

11 DECEMBER 1958

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IN CHEMICAL, BIOLOGICAL AND RADIOLOGICAL  
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## The U. S. Army Research and Development Program in CBR

Fiscal Year 1959

### INTRODUCTION

The Chemical Corps Research and Development Program for FY 1959 is an increment in the progressive execution of the long range program which has been established for the eventual achievement of goals to provide a capability in these fields. This program has been tailored to provide for the early completion of chemical and biological munitions combinations for limited and general war applications, to provide a proper balance between research and development, and to accomplish the necessary research to support the future development of CBR systems to provide, and be consistent with, new concepts of warfare. The current program emphasizes the provision of CBR materiel which will exploit the particular potential of these systems for use in limited war. The program is designed to conform with the guidance set forth by the Chief, Research and Development, Department of the Army.

A limited amount of work is accomplished for and funded by agencies other than the Chief, Research and Development, Department of the Army, which in FY 1959 is expected to amount to approximately \$2 million, some 20% less than in FY 58. These resources, provided by such agencies as the Air Force, the Navy and other Department of the Army and Defense agencies, are for specific purposes delineated by these agencies.

### Funding Level

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The current Department of the Army level of funding for the CBR Research and Development Program for FY 1959 is \$35,153,300. Deducting from this amount \$746,300 provided for special purposes such as: a revolving fund for "longevity funding of basic research contracts; funds for the completion of the FY 58 Program, and a Special Purpose Contract for the Chief, Research and Development, Army," the net funding level in support of the FY 59 Department of Army CBR research and development program is \$34,407,000. Although this is approximately \$1.9 million greater than the preceding fiscal year, the increase is more than offset by pay increases of about \$1.6 million granted to classified employees, increases to Wage Board employees (blue collar workers,) and increasing costs for contract work, supplies and materials.

### Program Based on Long Range Objectives and Goals

The U. S. Army Chemical Corps, in order to assure the proper orientation of its research and development program based on well defined goals, has established "The U. S. Army Chemical Corps Research and Development Program." This long range program includes technical objectives, program guidance and operating policies, and covers a period through FY 1970. The objectives and goals contained therein are based upon a funding level of approximately \$32 to \$35 million per year. The date of achievement of a satisfactory CBR capability has not been established for this level of funding.

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### Research vs Development

The FY 59 Chemical Corps Research and Development Program may be broken down as follows:

Research	\$13,097,000
Development	\$ 9,899,000
Operation and Management of Facilities	<u>\$11,411,000</u>
Special Purpose Funds	<u>\$34,407,000</u> <u>746,300</u>
	\$35,153,300

Since funds for operation and management of facilities are in direct support of the research and development effort, it will be noted that the program is divided:

57% in support of research, and

43% for development

### The Research Effort

Successful attainment of U. S. superiority in CBR warfare readiness depends heavily upon new knowledge derived from a strong program of research. Therefore, the greatest effort in the CBR R&D program is in research, as evidenced by the allocation of funds.

Major emphasis in the FY 59 research program is on:

- a. New agents, and means for their dissemination;
- b. Medical aspects and biological sciences research;
- c. Rapid warning and protection;
- d. Assessment.

### Development

As new CBR agents are provided from the research program, it is necessary to develop production methods, and to provide our Armed Forces with munitions capable of exploiting the new agent potential. Further, the Armed Forces must be furnished with defensive equipment required for the higher levels of protection necessarily required..

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To meet this need, the development program, in fiscal year 1959, emphasizes:

- a. Development of guided missile and ballistic rocket delivery systems for CBR;
- b. Development of area toxic rockets, land mines, shells, generators and large area coverage systems;
- c. Development of warning, detection and protective materiel;
- d. Development of procedures and equipment for Nuclear Warfare Defense;
- e. Field testing of CBR materiel.

In-House vs Contract

In view of the type of work involved, and the type of facilities required, a large proportion of the CBR Research and Development Program must necessarily be accomplished within government facilities. In the FY 59 program the breakdown of funds between in-house and contract work is as follows:

In-House	\$32.0 million	93%
Contract	* 2.4 million	7%
	\$34.4 million	100%

The current contract program includes 114 contracts, 74 of which are in the research area and 40 in development. Sixty-seven are placed with universities and non-profit organizations, and 47 are with industrial concerns.

(U) Although the contract program has been larger in prior years, the level in FY 59 provides the best balance between in-house and contract within resources available.

Personnel

(U) Personnel engaged in the in-house effort of the CBR Research and Development Program consist of a military-civilian team of approximately 5100 persons. Included therein are highly qualified officers and enlisted men with advanced degrees in the sciences, and civilian professionals with advanced degrees, long experience in their specialties and high standing in the scientific community.

\* \$536 thousand for longevity funding of research contracts not included.

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The personnel in the CBR Research and Development Program for FY 59 may be broken down as follows:

<u>Civilian</u>		<u>Military</u>	
Professional	929	Officer	215
(PhD - 183)		Enlisted	1131
(MS & BS - 746)		(Professional	
Other	2861	587)	
	3790		1346

Total - 5136

The Program in Detail

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In order to facilitate a more detailed examination of the FY 59 CBR Research and Development Program there is included in the following pages more extensive information on the program. With reference to the dollar figures indicated under the heading "PROPOSED" on these pages, it will be noted that the total program amounts to \$125,150,000 per annum as proposed by the Chemical Corps in its presentation to the special panel of President's Science Advisory Committee at the Executive Offices of the President on 18 October 1958. This funding level, as proposed by the Chemical Corps, has not been staffed at Department of the Army level.

PROJECT SUMMARY

Research Program

Biological Warfare Laboratories (BWL) Research Program .

<u>PROJECT TITLE</u>	<u>*PRESENT (Thousands)</u>	<u>PROPOSED (Thousands)</u>
BW Munitions Research	\$ 1,400	\$ 4,264
Viral & Rickettsial Agent Research	650	5,100
Bacterial & Fungal Agent Research	750	4,880
Entomological BW Research	120	3,500
Research on BW Rapid Warning Systems	250	1,220
BW Agent Process Research	1,495	3,000
Protective Measures for Personnel Engaged in BW Program	880	3,150
BW Assessment Technology	280	1,190
Risk to Armed Forces from BW Attack	1,000	2,360
Aerobiological Research	1,160	4,410
Sub-Total BWL Research	7,985	33,074

\* As of October 1958.

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Chemical Warfare Laboratories (CWL) Research Program

<u>PROJECT TITLE</u>	<u>PRESENT (Thousands)</u>	<u>PROPOSED (Thousands)</u>
CW Agent Dissemination Research	\$ 755	\$ 2,720
CW Agent Research	1,195	8,850
Flame & Incendiary Research	45	317
Medical Aspects of CW	652	2,370
CW Biological Sciences Research	1,245	5,610
Health Hazards of Military Chemicals	10	280
CW Protective Research	185	640
Chemical Corps Materials Research	90	370
Sub-Total, CWL Research	<u>4,177</u>	<u>21,157</u>

Dugway Proving Ground (DPG) Research Program

Large Area Particulate Cloud Travel	200	822
Cloud Physics of Toxicological Warfare, DPG	300	3,000
Ecology & Epidemiology, DPG	185	640
CBR Field Test Technology, DPG	<u>250</u>	<u>1,120</u>
Sub-Total, DPG Research	<u>935</u>	<u>5,582</u>
 TOTAL RESEARCH	 13,097	 59,813

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DEVELOPMENT PROGRAM

Biological Warfare Laboratories (BWL) Development Program

<u>PROJECT TITLE</u>	<u>PRESENT (Thousands)</u>	<u>PROPOSED (Thousands)</u>
BW Warheads for Rockets & Missiles	\$ 150	\$ 992
Special BW Operations	400	643
BW Munitions Development	385	1,050
BW Product and Process Engineering	205	824
BW Agent Process Development	773	2,500
Anti-Crop Warfare	200	2,000
Sub-Total, BWL Development	2,113	8,009

Chemical Warfare Laboratories (CWL) Development Program

CW Warheads for Rockets & Missiles	1,515	2,900
Flame Warfare Materiel	240	627
Toxic CW Munitions	1,210	2,910
Signalling & Screening Smokes	25	466
Engineering Design, Specifications and Testing	255	855
CW Agent Process Development	360	4,500
CW Warning and Detection	465	1,600
Nuclear Warfare Defense	570	2,250
Combat Surveillance Countermeasures (non-elect)	60	230
CW-BW Protective Materiel	900	3,100
Sub-Total, CWL Development	5,600	19,438

Dugway Proving Ground (DPG) Development Program

Environmental Field Testing, DPG	200	810
CBR Field Testing, DPG	1,986	5,580
Sub-Total, DPG Development	2,186	6,390
TOTAL DEVELOPMENT	9,899	33,837
Operation and Management of Facilities	11,411	20,000
Extra Continental Site		11,500
GRAND TOTAL	34,407	125,150

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PROJECT DETAILS

1. (U) Project Title: BW Munitions Research
2. (U) Purpose: The distribution of BW agents in optimum concentration over various areas, geometries and types of targets is necessary to exploit the inherent advantages of BW agents. Methods for accomplishing this objective can best be obtained by an imaginative program of specialized research in dissemination and dispersion concepts for which the project provides.
3. (U) Objective: To provide methods of maximum effectiveness for the dissemination of BW agents from munitions, the dispersion of munitions from delivery systems, and to determine the technical feasibility of various potential BW weapon systems.
4. (U) Funding:

<u>Present</u>	<u>Proposed</u>
\$1400M	\$4264M
5. Scope: This program includes:
  - a. Dissemination Research on BW Agents - Research on continuous generator concepts for both liquid and dry agents which will provide a basis for large area munition design. Research in explosive generation in bomblet type munitions for missile delivery.
  - b. Research on BW Munitions Concepts - Research is proceeding on operational and technical feasibility studies on BW sprays and self-dispersing bomblets. Preliminary designs are being completed for large area dry agent disseminators. Tests utilizing rotating shapes are in progress utilizing agents P. tularensis, Br suis and Q fever to establish source strengths and infectivity.
  - c. Assessment of Munitions - Approximately 30% of the funds in the Munitions Research Project are expended for the evaluation of munitions prototypes described in a and b above.
6. Contract Program in Support of this Project:
  - a. (1) Contract Title: Research Studies on the Physics and Biophysics of Explosive Dissemination
  - (2) Contractor: George Washington University
  - (3) Scope: The development of information concerning physical and biophysical phenomena which affect dissemination of viable aerosols by explosive means.
  - (4) Date of Initiation: June 1956
  - (5) Date of Expiration: May 1959
  - (6) Amount Funded to Date: \$545,000

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(U) Project Title: BW Munitions Research

- (7) FY 59 Funding Requirement: \$110,000
- (8) Principal Investigator: Dr. Benjamin B. Van Era
- b. (1) Contract Title: Theoretical Models for BW Target Effectiveness
- (2) Contractor: Leland Stanford Jr. University
- (3) Scope: To develop concepts and theoretical models appropriate to the quantitative appraisal of target effectiveness of BW weapons systems with emphasis on the establishment of criteria for the development of optimal BW munitions.
- (4) Date of Initiation: August 1956
- (5) Date of Expiration: September 1959
- (6) Amount Funded to Date: \$232,400
- (7) FY 59 Funding Requirement: None
- (8) Principal Investigators: Dr. Philip Leighton and Dr. William Perkins
- c. (1) Contract Title: Wind Tunnel Tests of Flettner Shapes
- (2) Contractor: University of Minnesota
- (3) Scope: Conduct wind tunnel tests to measure the aerodynamic stability and performance parameters of some self-dispersing Flettner shapes.
- (4) Date of Initiation: June 1957
- (5) Date of Expiration: June 1959
- (6) Amount Funded to Date: \$56,800
- (7) FY 59 Funding Requirement: None
- (8) Principal Investigator: Mr. Richard DeLeo
- d. (1) Contract Title: Low Altitude Liquid BW Spray System
- (2) Contractor: North American Aviation, Incorporated

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(U) Project Title: BW Munitions Research

(3) Scope: Investigate and establish the characteristics of a high flow spray system for liquid antipersonnel agents using high speed delivery vehicles at low altitudes to cover downwind target areas of 1,000 square miles.

(4) Date of Initiation: December 1957

(5) Date of Expiration: November 1958

(6) Amount Funded to Date: \$285,836

(7) FY 59 Funding Requirement: \$18,564

(8) Project Officer: Dr. Keyser

e. (1) Contract Title: Temperature, Altitude and Humidity Test Chamber

(2) Contractor: Tenny Engineering, Incorporated

(3) Scope: Develop, fabricate, deliver, install and test one (1) temperature, altitude and humidity test chamber and associated equipment in accordance with specifications.

(4) Date of Initiation: June 1956

(5) Date of Expiration: August 1958

(6) Amount Funded to Date: \$88,185

(7) FY 59 Funding Requirement: None

(8) Project Officer: Mr. G. Mader

f. (1) Contract Title: Research in Assessment Technology

(2) Contractor: Armour Research Foundation of Illinois  
Institute of Technology

(3) Scope: Conduct comprehensive investigations of specific problems in assessment technology.

(4) Date of Initiation: March 1958

(5) Date of Expiration: March 1959

(6) Amount Funded to Date: \$93,760

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(U) Project Title: BW Munitions Research

(7) FY 59 Funding Requirement: None

(8) Project Officer: Mr. L. Idoine

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1. (U) Project Title: Viral and Rickettsial Agent Research

2. ~~■~~ Purpose: To obtain viral and rickettsial agents that are lethal or incapacitating when used in an offensive weapon in BW. These agents must also exhibit characteristics of storage stability, infective dose, aerosol stability, pathogenesis, resistance to therapeutic materials and capability of being produced and disseminated appropriately to their intended munition and logistic system.

3. (U) Objective: To obtain viral and rickettsial agents having maximum effectiveness in Biological Warfare.

4. (U) <u>Funding:</u>	<u>Present</u>	<u>Proposed</u>
	\$650M	\$5100M

5. ~~✍~~ Scope: This program includes:

a. Viral and Rickettsial Agent Laboratory Research: Collections of strains of Variola and preparation of seed stocks have been completed, and storage stability studies and aerosol infectivity studies have been started. An optimum strain of Variola will be selected and studied more extensively as to aerosol and biological properties.

Production of tissue cells by submerged tissue culture had been demonstrated and Venezuelan Equine Encephalitis (NU) is being adapted to this method of production. Adaptation of Japanese B. Encephalitis (AN) or Variola is being attempted. Methods for the isolation of variants of NU have been accomplished, and concentration and purification methods are being studied.

In all studies relating to NU, the technique will be applicable to many other viruses.

b. Selection of Candidate Viral and Rickettsial Agents: Screening on Variola, AN, and Eastern Equine Encephalitis (ZX) has been completed and screening of ZX as an arthropod-transmitted agent started. Screening of dengue and yellow fever has also been initiated. Screening on Rocky Mountain Spotted Fever as an aerosol was completed and the information is being evaluated.

6. Contract Program in Support of This Project:

- (1) Contract Title: Investigation of Submerged Culture Techniques
- (2) Contractor: Trustees of the University of Pennsylvania
- (3) Scope: Conduct investigations of submerged culture techniques for propagation of mammalian cells and an adaptation of these techniques to cultivation of viruses and rickettsiae

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(U) Project Title: Viral and Rickettsial Agent Research

(4) Date of Initiation: June 1955

(5) Date of Expiration: May 1960

(6) Amount Funded to Date: \$337,075

(7) FY 59 Funding Requirement:

(8) Principal Investigator: Dr. William McLimins

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1. (U) Project Title: Bacterial and Fungal Agent Research

2. Purpose: To obtain bacterial and fungal agents that are lethal or incapacitating when used as a component of an offensive weapon in BW. These agents must also exhibit characteristics of storage stability, infective dose, aerosol stability, pathogenesis, resistance to therapeutic materials, and capability of being produced and disseminated appropriate to their intended munition and logistic system.

3. (U) Objective: To obtain bacterial and fungal agents having maximum effectiveness in Biological Warfare.

4. (U) <u>Funding:</u>	<u>Present</u>	<u>Proposed</u>
	\$750M	\$4880M

5. Scope: This program includes the following:

a. Bacterial and Fungal Agents Laboratory Research - Studies are in progress to obtain new agents which will provide greater lethality, shortened incubation periods, aerosol stability adapted to long range aerosol cloud travel, and other properties giving greater effectiveness, flexibility and predictability to BW weapons systems. Project "Whitecoat" to establish the minimum lethal dose and protection afforded by the various vaccines for tularemia in man, and studies on genetics, aerosol and storage stability, antibody resistance, nutritional requirements and factors affecting virulence are in progress on such candidate agents as P. pestis, B. anthracis and M. Pseudomallei and C. immitis.

b. Selection of Candidate Bacterial and Fungal Agents - It is required that disease-producing bacterial and fungal agents not yet researched be examined for their potential as BW agents. Literature reviews and feasibility studies are conducted on promising candidates.

6. Contract Program in Support of this Project:

a. (1) Contract Title: Genetic Aspects of Host Parasite Interactions

(2) Contractor: Rutgers State University

(3) Scope: Conduct investigations of the interaction between mammalian tissue cultures (monocytic) and various genotypes of selected bacterial species.

(4) Date of Initiation: September 1957

(5) Date of Expiration: August 1959

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Project Title: Bacterial and Fungal Agent Research

(6) Amount Funded: \$31,980

(7) FY 1959 Funding Requirements:

(8) Principal Investigator: Dr. Werner Braun

b. (1) Contract Title: Studies on Malleomyces Group and other Organisms (ONR Contract NR-ONR29536)

(2) Contractor: University of California

(3) Scope: Conduct studies on malleomyces group and other organisms to include: (1) maintenance of stock strains and strain selection, (2) serological tests for identification of strains, (3) aerosol infectivity of various strains in certain animals, (4) aerostability of various organisms in the Dynamic Aerosol Toroid.

(4) Date of Initiation: October 1957

(5) Date of Expiration: October 1959

(6) Amount Funded: \$300,000

(7) FY 1959 Funding Requirements: \$100,000

(8) Principal Investigator: Dr. Carl Lamanna - Dr. Ralph Muckenfu

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1. (U) Project Title: Entomological BW Research

2. Purpose: Effort under this project is necessary to obtain BW agents and arthropod vectors most suitable for military purposes. Entomological BW makes possible the use of certain agents and poses defensive problems which make it a valuable complement to aerosol type BW weapon systems.

3. (U) Objective: To obtain agents and vectors having maximum effectiveness for entomological BW.

4. (U) <u>Funding:</u>	<u>Present</u>	<u>Proposed</u>
	\$120M	\$3500M

5. Scope: Arthropod vector systems afford a means of BW not dependent on the respiratory route of infection. The feasibility of such weapon systems has been established, but research is required to extend its capabilities to maximum potential. Studies are in progress on the effects of environment and delivery systems on uninfected insects, mass infection and transmission studies, employing yellow fever, Eastern equine encephalitis and P. Pestis in appropriate vectors. Type classification of the mosquito yellow fever and mosquito-Eastern equine encephalitis is in progress. Various field trials to test operational concepts for delivery are an important part of this project.

6. Contract Program in Support of this Project:

a. (1) Contract Title: Field Testing of Arthropods

(2) Contractor: U. S. Public Health Service (CDC)

(3) Scope: Perform investigation to determine (1) rate and extent of dispersion of specific numbers of mosquitoes released in cities, (2) effectiveness of released mosquitoes in biting human beings, (3) the vector effectiveness of mosquitoes in transmitting selected agents, (4) assist in the execution and assessment of air drops and other field tests.

(4) Date of Initiation: July 1954

(5) Date of Expiration: June 1959

(6) Amount Funded to Date: \$90,000

(7) FY 59 Funding Requirement: \$20,000

(8) Principal Investigator: Dr. Herbert S. Schoof

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1. (U) Project Title: Research on BW Rapid Warning Systems
2. (U) Purpose: Since BW agents in aerosols of operational quantities are not detectable by human senses or by known instruments, warning device providing instantaneous warning is required in order that personnel may employ defensive equipment in a timely manner.
3. (U) Objective: To obtain a research prototype of a device to provide rapid warning of BW attack.
4. (U) Funding:

<u>Present</u>	<u>Proposed</u>
\$250M	\$1220M
5. Scope: This program includes the following:
  - a. Physical Principles for Protection - There is no BW agent rapid warning device available which possesses all of the desirable characteristics. Prototypes have been developed using various principles with varying degrees of success. Examples are: a detector for protein virus; a rapid analysis of protein by pyrolyses; infrared detection and fluorescent techniques. A miniaturized instrument for particle analysis and for aerosol collection and concentration is under development, as is also a partichrome analyzer (a bacterial detector).
  - b. Biological Principle of Detection - Work is in progress on biological principles for rapid warning such as selected metabolic processes and serological techniques including fluorescent antibody techniques.
6. Contract Program in Support of this Project:
  - a. (1) Contract Title: Investigations Leading to the Mechanization of Collection and Staining Procedures
  - (2) Contractor: Photomechanisms, Inc.
  - (3) Scope: Develop and furnish a device capable of automatically transporting tape containing impacted particulate matter, and to be usable in conjunction with a scanning unit now being developed by the Polaroid Corp.
  - (4) Date of Initiation: September 1958
  - (5) Date of Expiration: September 1959

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**Project Title: Research on BW Rapid Warning Systems**

(6) Amount Funded: \$24,825

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(7) FY 1959 Funding Requirements: None

(8) Principal Investigator: Dr. Bolduan

b. (1) Contract Title: Development of Methods for the Rapid Identification of Bacteria by Means of Bacteriophage

(2) Contractor: Kansas State College

(3) Scope: Conduct studies, tests and experimental investigations to develop methods for the rapid identification of bacteria in pure and mixed cultures.

(4) Date of Initiation: July 1956

(5) Date of Expiration: June 1959

(6) Amount Funded: \$45,000

(7) FY 1959 Funding Requirements: None

(8) Principal Investigator: Dr. A. Eissenstark

c. (1) Contract Title: Investigation of the Use of Fluorescent Antibodies for the Rapid Detection and Identification of Bacteria

(2) Contractor: University of Maryland

(3) Scope: Conduct studies relative to the detection and identification of pathogenic bacteria by the use of fluorescent antibodies.

(4) Date of Initiation: November 1956

(5) Date of Expiration: October 1959

(6) Amount Funded: \$48,750

(7) FY 1959 Funding Requirements: None

(8) Principal Investigator: Dr. P. Arne Hansen

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Project Title: Research on BW Rapid Warning Systems

- d. (1) Contract Title: Investigations Leading to the Development of a Continuous Protein Detector
- (2) Contractor: Mine Safety Appliances Company
- (3) Scope: Investigate the development of a continuous protein detector based upon pyrolysis principles.
- (4) Date of Initiation: June 1957
- (5) Date of Expiration: April 1959
- (6) Amount Funded: \$29,155
- (7) FY 1959 Funding Requirements: None
- (8) Principal Investigator: Mr. J.P. Strange
- e. (1) Contract Title: Design and Fabrication of the Scanner Portion of a Partichrome
- (2) Contractor: Polaroid Corporation
- (3) Scope: Design and fabricate and furnish the scanner portion of a partichrome.
- (4) Date of Initiation: April 1958
- (5) Date of Expiration: September 1959
- (6) Amount Funded: \$58,350
- (7) FY 1959 Funding Requirements: None
- (8) Principal Investigator: Tech. Sup. Dr. E.R. Blout

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1. (U) Project Title: BW Agent Process Research
2. (U) Purpose: The scale-up investigations from research laboratory to production are necessary to provide BW agent capability. Process research at the laboratory level is economical since variables can be studied in the laboratory more easily and more quickly than in pilot plants.
3. (U) Objective: To provide for laboratory research on production processes in order to translate laboratory techniques into production potentials.
4. (U) Funding:

<u>Present</u>	<u>Proposed</u>
\$1495M	\$3000M
5. Scope: This program includes the following:
  - a. Process Research on Viral and Rickettsial BW Agents - Details of the process for production of dry coxiella burnetii (OU) will be studied. Dried OU will provide an incapacitating agent for very large area coverage of up to 100,000 square miles (20-50 fold increase over wet OU). In addition, process research will provide more information for determining the production potential of tissue culture techniques for growing all viruses, including those which are now impossible to grow. This should produce virus with greater virulence for man.
  - b. Process Research on Bacterial and Fungal Agents - Process variables affecting aerosols of dry P. tularensis (UL) will be studied. Various chemical stabilizers will be tested to improve aerosol characteristics of the agent. Process research studies on dried P. Pestis (LE) will be carried out. The success of process research will lead to development of dry BW agents with high potential source and low decay rate.
  - c. Biological Engineering Research - A spray dryer will be used to determine the feasibility of drying a suitable dispersed suspension of agent to particles of 1-3 microns in diameter. A fundamental understanding of spray drying will enhance the possibility of producing dry BW agents in more effective concentrations and lower costs through another fundamental approach to drying of usable BW agents. In addition to the above, agents and simulants will be produced to support research efforts of the BW program as required.
  - d. Assessment of BW Agents Process Research - Viral and bacterial agents in process research will be evaluated in test spheres and tanks using fixtures and prototype munitions. Evaluations of the agents is necessary in assessing the process potential for the agents in the program.

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Project Title: BW Agent Process Research

6. Contract Program in Support of this Project:

- a. (1) Contract Title: Design for a Spray Drying System for Heat Sensitive Materials.  
(2) Contractor: Regents of the University of Wisconsin  
(3) Scope: Prepare the design criteria for a spray drying system for heat sensitive materials, in sufficient detail to allow for the design and construction of such a system.  
(4) Date of Initiation: November 1956  
(5) Date of Expiration: December 1958  
(6) Amount Funded: \$6,900  
(7) FY 1959 Funding Requirements: \$3,312  
(8) Principal Investigator: Dean W.R. Marshall, Jr.
- b. (1) Contract Title: Factors Affecting Nutrition, Physiology and Storage Stability of Bacteria Belonging to the Genus Pasteurella  
(2) Contractor: University of Texas  
(3) Scope: Conduct studies relative to determining the factors affecting nutrition, physiology and storage of bacteria belonging to the genus Pasteurella  
(4) Date of Initiation: September 1958  
(5) Date of Expiration: August 1959  
(6) Amount Funded: \$7,150  
(7) FY 1959 Funding Requirements: \$7,150  
(8) Principal Investigator: Dr. O.B. Williams
- c. (1) Contract Title: Investigation of High Temperature Diaphragms and Valves  
(2) Contractor: Hills-McCanna Company

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Project Title: BW Agent Process Research

- (3) Scope: Furnish sample valves with diaphragms, for test at Fort Detrick for the purpose of determining the degree of durability and efficiency of operation of the complete unit under simulated and/or actual plant operation. In addition, to recommend for test any additional experimental valves or diaphragms meeting minimum conditions.
- (4) Date of Initiation: January 1957
- (5) Date of Expiration: January 1959
- (6) Amount Funded:
- (7) FY 1959 Funding Requirements:
- (8) Principal Investigator: None
- d. (1) Contract Title: Design and Fabrication of a Spray Drying System
- (2) Contractor: Bowen Engineering, Inc.
- (3) Scope: Design a complete spray drying system in accordance with certain engineering and design criteria. Upon approval of design, to fabricate, supervise installation and operation, and to make any alterations deemed necessary.
- (4) Date of Initiation: June 1957
- (5) Date of Expiration: December 1958
- (6) Amount Funded: \$124,640
- (7) FY 1959 Funding Requirements: \$19,970
- (8) Principal Investigator: Mr. Donald Belcher
- e. (1) Contract Title: Investigation of Methods of Concentration by Flotation and/or other appropriate Techniques.
- (2) Contractor: Massachusetts Institute of Technology

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Project Title: BW Agent Process Research

- (3) Scope: Conduct studies of methods of concentration by floatation and other appropriate techniques to include ability to withstand concentration and the effects on microorganisms of stress occurring during concentration. In addition, study possible means of surrounding microorganism with a thin film of substance to protect it from exposure to water or unfavorable atmospheric conditions.
- (4) Date of Initiation: July 1957
- (5) Date of Expiration: June 1959
- (6) Amount Funded: \$49,500
- (7) FY 1959 Funding Requirements:
- (8) Principal Investigator: Professor A.M. Gaudin

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1. (U) Project Title: Protective Measures for Personnel in the BW program
2. (U) Purpose: The purpose of this project is to protect personnel engaged in the BW program as well as inhabitants of nearby communities from infection and disease by BW agents.
3. (U) Objective: The objective of this project is to provide necessary protection to personnel engaged in the BW program and to inhabitants of surrounding communities.
4. (U) Funding:

<u>Present</u>	<u>Proposed</u>
\$880M	\$3150M
5. Scope: This program includes the following:
  - a. Safety Measures for Protection Against BW R&D Hazards - Continuing program of inspection and testing to determine extent and nature of hazards by development of new techniques, apparatus, decontaminants and procedures for safe operation.
  - b. Clinical Investigation Related to BW R&D Hazards - In cases of occupational disease, all pertinent clinical and laboratory data is assembled and is correlated with epidemiological data from the research laboratory. Extensive program of periodic immunization and medical examination of personnel working in hazardous area is conducted.
  - c. Biological Measures for Protection Against BW R&D Hazards - Hazards of Botulinum toxoids and Anthrax vaccines are evaluated. Research on production and assay methods for Anthrax vaccines is carried on as well as work on tularemia and other vaccines.
6. Contract Program in Support of this Project:
  - a. (1) Contract Title: Studies and Investigations of Antigens of Bacterium Tularensis
  - (2) Contractor: University of Utah
  - (3) Scope: Develop procedures for the elaboration and isolation of antigenic substances from cultures and culture filtrates of Bacterium tularensis and evaluate, in animals, the protective activity of the antigen preparations.
  - (4) Date of Initiation: July 1955
  - (5) Date of Expiration: July 1959
  - (6) Amount Funded to Date: \$15,175
  - (7) FY 1959 Funding Requirements: None

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Project Title: Protective Measures for Personnel in the BW program

(8)-Principal Investigator: Dr. Paul Nicholas

b. (1) Contract Title: Medical Investigation

(2) Contractor: John Hopkins University

(3) Scope: Conduct a critical review of pertinent clinical records and medical literature; consultation with appropriate authorities in the field; systematic clinical studies of cases of infectious diseases at Fort Detrick and Johns Hopkins Hospital for their significance in providing a more thorough understanding of infectious disease processes and the susceptibility of man to such disease; therapeutic studies etc.

(4) Date of Initiation: August 1955

(5) Date of Expiration: July 1962

(6) Amount Funded to Date: \$409,000

(7) FY 1959 Funding Requirement: \$159,000

(8) Principal Investigator: Dr. Leighton E. Cluff

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1. (U) Project Title: BW Assessment Technology
2. (U) Purpose: To provide for the development of new evaluation methods and assessment routines essential for the laboratory and chamber evaluation of new BW agents, munitions, or agent-munition combinations.
3. (U) Objective: To provide the laboratory and chamber techniques to enable adequate evaluation of new BW agents and/or munitions.
4. (U) Funding:

<u>Present</u>	<u>Proposed</u>
\$280M	\$1190M
5. Scope: This program includes:
  - a. Biological and Physical BW Assessment Methods - This provides for development of assessment methods for application to new agents and munitions to assure a means of obtaining data relative to agent and munition effectiveness. Present emphasis on dry agents and viral agents necessitates additional effort in this field.
  - b. BW Aerosol Chamber Technology - This provides for development and adaptation of methods for evaluation of new agents and munitions through multiple use to obtain data for evaluation of effectiveness.
6. (U) Contract Program in Support of This Project:
  - a. (1) Contract Title: Temperature, Altitude and Humidity Test Chamber
  - (2) Contractor: Tenny Engineering, Inc.
  - (3) Scope: Develop, fabricate, deliver, install and test one  
(1) temperature, altitude and humidity test chamber  
and associated equipment in accordance with specs.
  - (4) Date of Initiation: June 1956
  - (5) Date of Expiration: August 1958
  - (6) Amount Funded: \$88,185
  - (7) FY 1959 Funding Requirements: None
  - (8) Project Officer: Mr. E. Mader

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Project Title: BW Assessment Technology

- b. (1) Contract Title: Research in Assessment Technology
- (2) Contractor: Armour Research Foundation of Illinois Institute of Technology
- (3) Scope: Conduct comprehensive investigations of specific problems in assessment technology
- (4) Date of Initiation: March 1958
- (5) Date of Expiration: March 1959
- (6) Amount Funded: \$93,760
- (7) FY 1959 Funding Requirements: None
- (8) Principal Investigator: Project Officer: Mr. L. Idoine

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1. (U) Project Title: Risk to Armed Forces from BW Attack
2. (U) Purpose: It is necessary to obtain data and make a medical evaluation of the risk that enemy BW attack would have on U. S. Armed Forces so that adequate protective, prophylactic and therapeutic measures can be planned as warranted.
3. (U) Objective: To determine the risk to U. S. Armed Forces of enemy BW attack.
4. (U) Funding:

<u>Present</u>	<u>Proposed</u>
\$1000M	\$2360M
5. Scope: This program includes:
  - a. Vulnerability of Man to BW - Necessary data are being collected to determine the risk of BW attack to U. S. Armed Forces from a potential BW agent. In particular, these data refer to the dose for man, which is essential for BW planning. Necessary data are being compiled for two agents, Q Fever and P. tularensis, as well as for other agents.
  - b. Treatment of BW Casualties - The evaluation of preventive and therapeutic measures against specific BW agents is conducted in man. This will permit estimation of number of troops removed from duty by BW attack, length of time removed from duty, medical logistics factors, and similar planning. Final evaluation of Foshay vaccine and Russian type vaccine for tularemia is in progress. The work on Q Fever vaccine and therapy has been completed.
  - c. Laboratory Identification of BW Agents - Work is in progress to establish systematic approaches to the problem of laboratory identification of BW agents together with exploration and evaluation of the adequacy of known methods. Progress has been made on the adaptation of fluorescent antibody techniques and tissue culture methods to this problem.
6. Contract Program in Support of This Project:
  - a. (1) Contract Title: Assessment of the Effectiveness of Tularemia Vaccine in Man
  - (2) Contractor: Ohio State University Research Foundation
  - (3) Scope: This work is administered by Walter Reed Army Medical Unit
  - (4) Date of Initiation: January 1955
  - (5) Date of Expiration: December 1958
  - (6) Amount Funded to Date: \$223,000

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(U) Project Title: Risk to Armed Forces from BW Attack

(7) FY 59 Funding Requirement: None

(8) Principal Investigator: Dr. S. Saslaw

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1. (U) Project Title: Aerobiology Research

2. (U) Purpose: The research carried on under this project is necessary to provide BW agents possessing optimum aerosol characteristics for specific munition applications. Few BW agents have these characteristics in optimum form in nature, and this project seeks to measure the maximum improvement which can be attained and then to provide means for achieving it. It also provides munition designers with information as to the optimum aerosol particle sizes for infectivity and aerosol stability.

3. (U) Objective: To optimize the aerosol properties of BW agents for military weapon systems.

4. (U) <u>Funding:</u>	<u>Present</u>	<u>Proposed</u>
	\$1160M	\$4410M

5. Scope: This program includes:

a. Stability and Virulence of BW Aerosols - Research is done on the effects of aerosol stability of various candidate BW agents. Such factors as particle size and its effect on infectivity, environmental influences, age of the aerosol cloud and the effects of certain chemical adjuncts are considered. The information derived from these studies is essential to predictable munition effects calculations, lower dosages, firm troop safety distances and greater efficiency and effectiveness in the employment of BW weapons.

b. Pathogenesis of BW Aerosol Induced Infections - Basic research on the host-agent relationship is conducted. This involves histo-pathological and biochemical changes, the mechanism of host death and the factor of host resistance. The relation to infection of bacterial and animal lipids is studied. The pathogenesis of such organisms as P. tularensis, Venezuelan Equine Encephalomyelitis, P. pestis and B. anthracis and Varicella is studied. Knowledge of the pathogenesis will permit greater accuracy in casualty calculations and allow a rational approach to use of unnatural portals of entry.

6. (U) Contract Program in Support of this Project:

a. (1) Contract Title: Study of technique for diagnosing early progressive pulmonary disease

(2) Contractor: AVCO Manufacturing Corporation

(3) Scope: Studies will be made to determine whether or not knowledge of the amplitudes and frequencies of breath sounds offer a feasible technique for diagnosing early progressive pulmonary disease in man and experimental animals.

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(U) Project Title: Aerobiology Research

- (4) Date of Initiation: September 1958
- (5) Date of Expiration: September 1959
- (6) Amount Funded to Date: \$1
- (7) FY59 Funding Requirement: \$1
- (8) Project Officer: Capt. Middleton

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1. (U) Project Title: CW Agent Dissemination Research

2. Purpose: There is a need for continuous investigation to obtain information on the dissemination of chemical agents and to study new techniques and devices for the more effective use of such agents, as well as for basic design studies to improve significantly the functioning of CW munitions and their effective delivery and dispersion on target.

3. (U) Objective: To obtain basic information, both experimental and mathematical, on the dissemination and dispersion of CW agents which will lead to the development of improved CW weapons systems.

4. (U) <u>Funding:</u>	<u>Present</u>	<u>Proposed</u>
	\$755M	\$2720M

5. Scope: This program includes:

a. Dissemination Research on CW Agents - Research is in progress which will lead to the development of optimal type munitions for dissemination of toxic CW agents as aerosols, including improved self-dispersing bomblets for wide area coverage and devices for the attack of hard targets. Studies in progress include solids as well as liquids. Experimental models for the dissemination of V-agent are under investigation.

b. Mathematical Research on CW Dissemination - Results obtained here will provide a sound mathematical basis for the assessment of experimental CW munitions and will permit the results of wind tunnel studies to be correlated with field results. Special emphasis is being placed on mathematical aspects of casualty assessment. This work is being done under a special program entitled CARAMU.

c. Dissemination Research on Training and Test Agents - Included in this program is the search for realistic training and maneuver agent dissemination systems. Training systems and test agents are required to permit more realistic troop training in CW and increase the value of CW doctrine.

6. Contract Program in Support of this Project:

a. (1) Contract Title: Breath Recording System

(2) Contractor: Gulton Industries, Inc.

(3) Scope: Perform the research and development required to fabricate a production prototype recording system.

(4) Date of Initiation: September 1957

(5) Date of Expiration: December 1958

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(U) Project Title: CW Agent Dissemination Research

(6) Amount Funded to Date: \$162,819

(7) FY 59 Funding Requirement: None

(8) Principal Investigator: Dr. W. Wilkowitz

b. (1) Contract Title: Investigation of Explosive Dissemination  
of Liquid Agents

(2) Contractor: Stanford Research Institute

(3) Scope: To investigate theoretically and experimentally the dissemination of liquids by means of explosive devices. The contractor will review and evaluate data from Army Chemical Center field and explosive chamber test programs and develop theory on the basis of these results.

(4) Date of Initiation: September 1958

(5) Date of Expiration: September 1958

(6) Amount Funded to Date: \$50,000

(7) FY 59 Funding Requirement: \$50,000

(8) Principal Investigator: Dr. M. Kells

c. (1) Contract Title: Casualty Rate Assessment

(2) Contractor: University of Pennsylvania

(3) Scope: To furnish "operations research services" with respect to the casualty rate assessment program and/or its various aspects.

(4) Date of Initiation: May 1956

(5) Date of Expiration: January 1959

(6) Amount Funded to Date: \$209,512

(7) FY 59 Funding Requirement: \$100,000

(8) Principal Investigator: Dr. K. Krieger

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(U) Project Title: CW Agent Dissemination Research

- d. (1) Contract Title: Investigation of Hot Gas Generation of Aerosols of Low Volatility Liquids
- (2) Contractor: Southern Research Institute
- (3) Scope: To investigate theoretically and experimentally the hot gas generation of aerosols (less than 150 microns in diameter) from approximately three organic liquids of low volatility.
- (4) Date of Initiation: July 1957
- (5) Date of Expiration: August 1959
- (6) Amount Funded to Date: \$54,975
- (7) FY 59 Funding Requirement: None
- (8) Principal Investigator: Mr. R. Lacey
- e. (1) Contract Title: Mathematical and Statistical Services
- (2) Contractor: New York University
- (3) Scope: To develop and apply mathematical models to describe the effectiveness of CW agent-munition combinations when employed under operational conditions
- (4) Date of Initiation: July 1957
- (5) Date of Expiration: December 1958
- (6) Amount Funded to Date: \$37,000
- (7) FY 59 Funding Requirement: None
- (8) Principal Investigator: Dr. Woodbury

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1. (U) Project Title: CW Agent Research
2. (U) Purpose: There is a continuing requirement for the improvement of CW potential in the agents field. New agents must be sought which circumvent known protective measures, or which offer unique military potentialities as in the non-lethal incapacitating area. For these agents, methods for large-scale synthesis and analytical control must be available, as well as basic physiochemical data on reaction mechanisms relating to synthesis and stability, and on biochemical mechanism of action. This project supports basic research fundamental to the attainment of these stated objectives.
3. (U) Objective: To discover new and improved CW agents, of both lethal and incapacitating types, by the application of the research techniques of organic chemistry, physical chemistry, analytical chemistry, and biochemistry.
4. (U) Funding:

<u>Present</u>	<u>Proposed</u>
\$1195M	\$8850M
5. Scope: This program includes:
  - a. New Agent Research - An industrial liaison program is conducted to provide for systematic visits to industrial and academic laboratories for the solicitation of new compounds, ideas, or procedures of potential interest to the Chemical Corps. An accelerated program is being conducted in house and by contract on incapacitating agents such as tetrahydrocannabinol (compounds related to marijuana) as well as other compounds having incapacitating action or which offer promise as training or maneuver agents. A program to collect information which will permit synthesis of lethal agents of the types other than V and G agents is being investigated. They include such substances as shellfish, puffer fish and botulinum poisoning.
  - b. Agent Analytical Research - Methods are being developed for the analysis of V agents and intermediates in the support of laboratory and pilot plant programs. This program includes the improvement of analytical procedures for basic chemical research and field assessment of new agents.
  - c. Agent Physiochemical Research - Basic studies are conducted on the breakup of liquid and solid materials into small particle sizes and the characteristics of these particulates are determined. Included are wind tunnel studies on the effects of turbulence and aerosol stability. Results obtained are directly applicable to problems of aircraft spray and field dissemination of toxics. Work is also conducted on agent penetration of clothing, decontamination, storage stability and persistence of CW agents.

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(U) Project Title: CW Agent Research

d. Biochemical Action of CW Agents - Studies are in progress on the biochemical mechanism of action of toxic substances such as shell fish and puffer fish poisons, snake venoms and bacterial toxins. Knowledge of mechanism of biochemical action leads directly to the possibility of enhanced offensive and defensive effectiveness of CW agents.

6. Contracts in Support of This Project:

- a. (1) Contract Title: Studies of Certain Phosphorus Compounds
- (2) Contractor: National Bureau of Standards
- (3) Scope: Conduct thermodynamic and thermochemical studies on specific phosphorus compounds.
- (4) Date of Initiation: May 1957
- (5) Date of Expiration: December 1958
- (6) Amount Funded to Date: 40,000
- (7) FY 59 Funding Requirement: None
- (8) Principal Investigator: Mr. D. Wagman
- b. (1) Contract Title: Screening of Natural Products
- (2) Contractor: College of Medical Evangelists
- (3) Scope: To screen certain compounds from natural products for their applicability as possible CW agents and the isolation of their active components.
- (4) Date of Initiation: April 1954
- (5) Date of Expiration: November 1958 (Extension has been requested)
- (6) Amount Funded to Date: \$197,574
- (7) FY 59 Funding Requirement: \$25,000
- (8) Principal Investigator: Dr. G. T. Anderson
- c. (1) Contract Title: Purification of Organic Compounds
- (2) Contractor: Applied Science Laboratories, Inc.
- (3) Scope: Conduct research studies of physiochemical techniques for the purification of organic compounds.

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**(U) Project Title: CW Agent Research**

- (4) Date of Initiation: May 1958**
- (5) Date of Expiration: May 1959**
- (6) Amount Funded to Date: \$14,585**
- (7) FY 59 Funding Requirement: None**
- (8) Principal Investigator: Dr. A. Rose**

**d. (1) Contract Title: Penetration of Clothing**

- (2) Contractor: Harris Research Laboratories, Inc.**
- (3) Scope: Investigative studies to determine the factors which control the rate of penetration of clothing by organic liquids**
- (4) Date of Initiation: March 1958**
- (5) Date of Expiration: February 1959**
- (6) Amount Funded to Date: \$17,570**
- (7) FY 59 Funding Requirement: \$20,000**
- (8) Principal Investigator: Dr. Schwartz**

**e. (1) Contract Title: Coated Aerosols by Light Scattering**

- (2) Contractor: Clarkson College of Technology**
- (3) Scope: Prepare and investigate coated aerosols by light scattering techniques**
- (4) Date of Initiation: June 1958**
- (5) Date of Expiration: August 1959**
- (6) Amount Funded to Date: \$20,000**
- (7) FY 59 Funding Requirement: \$20,000**
- (8) Principal Investigator: Dr. M. Kerker**

**f. (1) Contract Title: Fundamental Investigations of the Breakup of Viscoelastic Fluid Jets**

- (2) Contractor: The Franklin Institute**

(U) Project Title: CW Agent Research

(3) Scope: To determine and establish the fundamental relationships governing the breakup of viscoelastic fluid jets at high velocities for application to the control of drop size formation

(4) Date of Initiation: November 1957

(5) Date of Expiration: August 1959

(6) Amount Funded to Date: \$46,945

(7) FY 59 Funding Requirement: \$24,960

(8) Principal Investigator: Dr. W. Philippoff

g. (1) Contract Title: Research on Natural Products

(2) Contractor: University of California

(3) Scope: To determine the chemical structure of a substance known as "SS." After the structure of this compound has been determined to devise a method of synthesis.

(4) Date of Initiation: May 1956

(5) Date of Expiration: November 1958 (Extension has been requested)

(6) Amount Funded to Date: \$25,800

(7) FY 59 Funding Requirement: \$14,000

(8) Principal Investigator: Dr. H. Rappaport

h. (1) Contract Title: Investigation of Withania Somnifera Alkaloids

(2) Contractor: University of Connecticut

(3) Scope: To determine the chemical nature and structure of the crystalline hypnotic alkaloid isolated from WITHANIA SOMNIFERA and to isolate sufficient quantities for activity screening.

(4) Date of Initiation: April 1958

(5) Date of Expiration: April 1959

(6) Amount Funded to Date: \$10,000



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(U) Project Title: CW Agent Research

(7) FY 59 Funding Requirement: None

(8) Principal Investigator: Dr. A. E. Schwarting

1. (1) Contract Title: Synthesis of Compounds

(2) Contractor: Boston University

(3) Scope: Conduct research on the synthesis of esters of certain compounds containing nitrogen and/or phosphorus

(4) Date of Initiation: May 1954

(5) Date of Expiration: July 1959

(6) Amount Funded to Date: \$55,106

(7) FY 59 Funding Requirement: \$10,000

(8) Principal Investigator: Dr. J. P. Mason

j. (1) Contract Title: Laboratories Facilities

(2) Contractor: University of California

(3) Scope: Install certain laboratory facilities

(4) Date of Initiation: January 1955

(5) Date of Expiration: January 1959

(6) Amount Funded to Date: \$12,854

(7) FY 59 Funding Requirement: None

(8) Principal Investigator: None

k. (1) Contract Title: Structure of Puffer Poison

(2) Contractor: Harvard College

(3) Scope: To investigate the crystalline substance known as Puffer Poison in order to determine its chemical structure and synthesize this material

(4) Date of Initiation: June 1958

(5) Date of Expiration: August 1959

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(U) Project Title: CW Agent Research

(6) Amount Funded to Date: \$25,000

(7) FY 59 Funding Requirement: None

(8) Principal Investigator: Dr. R. Woodward

1. (1) Contract Title: Investigation of Calabash Curare

(2) Contractor: University of Rochester

(3) Scope: To investigate the chemical nature and structure of the paralysis-causing alkaloids isolated from calabash plants such as Strychnos toxifera and to synthesize model compounds on the structure features of the alkaloids

(4) Date of Initiation: August 1958

(5) Date of Expiration: September 1961

(6) Amount Funded to Date: \$11,000

(7) FY 59 Funding Requirement: \$11,000

(8) Principal Investigator: Dr. V. Bochelheide

m. (1) Contract Title: Investigation of Ryanodine

(2) Contractor: University of California

(3) Scope: The elucidation of the chemical nature and structure of the skeletal muscle contracting alkaloid, ryanodine, isolated from Ryania Speciosa and the synthesis of simple model compounds based on the structural features of ryanodine.

(4) Date of Initiation: June 1958

(5) Date of Expiration: June 1959

(6) Amount Funded to Date: \$9,000

(7) FY 59 Funding Requirement: None

(8) Principal Investigator: Dr. H. Rappaport

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(U) Project Title: CW Agent Research

n. (1) Contract Title: New Approaches

(2) Contractor: University of Chicago

(3) Scope: To develop new and different approaches for the development of CW agents

(4) Date of Initiation: December 1953

(5) Date of Expiration: January 1959

(6) Amount Funded to Date: \$327,000

(7) FY 59 Funding Requirement: None

(8) Principal Investigator: Dr. T. Rudy

o. (1) Contract Title: The Effect of Molecular Structure on Catalysis and Molecular Binding

(2) Contractor: University of Wisconsin

(3) Scope: To determine, by means of chemical kinetic studies, the influence of molecular structure on the relative activity of organic catalytic and complexing agents

(4) Date of Initiation: October 1958

(5) Date of Expiration: September 1961

(6) Amount Funded to Date: \$10,000

(7) FY 59 Funding Requirement: None

(8) Principal Investigator: Dr. Higuchi

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1. (U) Project Title: Flame and Incendiary Research

2. (U) Purpose: There is a continuing requirement for research on flame and incendiary agents and dissemination devices, to take military advantage of advances in technology in these important areas and thereby increase field capabilities in flame and incendiary warfare significantly beyond the present levels.

3. (U) Objectives: To discover improved flame and incendiary agents and means for their military use.

4. (U) <u>Funding:</u>	<u>Present</u>	<u>Proposed</u>
	\$45M	\$317M

5. Scope: Studies are being made of the design parameters of flame throwers as related to fuel characteristics; on the feasibility of chemical ignition of flame thrower fuel, and on thickeners on incendiary fuels, including rheological investigations. Initial studies are in progress on the use of new high calorie fuels as incendiary agents.

6. Contract Program in Support of This Project:

a. (1) Contract Title: Stabilization of Butadiene Polymers

(2) Contractor: University of Akron

(3) Scope: Conduct studies on the stabilization against deterioration at 160°F of certain polymers of butadiene.

(4) Date of Initiation: May 1957

(5) Date of Expiration: July 1959

(6) Amount Funded to Date: \$29,500

(7) FY 59 Funding Requirement: None

(8) Principal Investigator: Dr. M. Morton

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1. (U) Project Title: Medical Aspects of CW Warfare

2. (U) Purpose: There is a continuing requirement for a complete medical knowledge of diagnostic, prophylactic, antidotal and therapeutic drugs, devices and procedures to estimate accurately the severity of exposure to CW agents and provide adequate medical treatment of poisoning in man.

3. (U) Objective: To provide a basis for the treatment of Chemical Warfare casualties and to conduct medical research essential for both defensive and offensive warfare.

4. (U) <u>Funding:</u>	<u>Present</u>	<u>Proposed</u>
	\$652M	\$2370M

5. Scope: This program includes:

a. Clinical Investigation and Treatment of CW Casualties - Broad exploratory research is in progress to gather information from which to form a basis for attaining more effective first aid and treatment measures for CW agent poisoning and permit a more accurate estimation of casualty production rates for agents GB and VX. Study of VX in man is in progress.

b. Incapacitating Action of CW Agents - Research is being conducted to obtain a better understanding of the mechanism and site of action of incapacitating agents, including psychochemicals. Also, potential antidotal and blocking drugs against such agents are being tested.

c. Pathological Actions of CW Agents - Research is being conducted on the pathology of CW agents in an attempt to discover new scientific facts concerning lethal and incapacitating sites of action. These studies reveal whether the injuries produced are reversible or irreversible and form a basis for evaluation of CW agents.

d. Human Factors Research - Human engineering studies are performed to evaluate all items including protective and treatment devices to insure that design of final end items will permit utilization by troops with optimal efficiency.

e. Development of Protective and Treatment Items - Final engineering tests are in progress on a cholinesterase blood determination kit which will provide a simple means for determining the blood cholinesterase level in the body of an individual in order to screen troops who may have been exposed to G or V agents. A mask-to-mask resuscitator which provides a means for conducting artificial ventilation of nerve gas casualties is also under development and is presently undergoing final engineering testing.

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(U) Project Title: Medical Aspects of CW Warfare

6. Contract Program in Support of this Project:

- a. (1) Contract Title: Effects of CW and Candidate Therapeutic Agents
- (2) Contractor: University of Maryland
- (3) Scope: Conduct Neuro, Chemical, Physiological, Psychological, Psychiatric Studies of Effects of CW and Candidate Therapeutic Agents
- (4) Date of Initiation: March 1957
- (5) Date of Expiration: June 1959
- (6) Amount Funded to Date: \$71,321
- (7) FY 59 Funding Requirement: \$25,000
- (8) Principal Investigator: Dr. Finesinger
- b. (1) Contract Title: Neurological Action of CW Agents
- (2) Contractor: University of Washington
- (3) Scope: To Study and Evaluate the Action of Certain Psychotomimetic and Tranquilizing Compounds on Animals and Human Subjects
- (4) Date of Initiation: April 1957
- (5) Date of Expiration: September 1959
- (6) Amount Funded to Date: \$100,000
- (7) FY 59 Funding Requirement: \$40,000
- (8) Principal Investigator: Dr. Dille
- c. (1) Contract Title: Neurological and Psychiatric Changes
- (2) Contractor: Tulane University
- (3) Scope: Conduct Clinical Studies during the administration of Chlorpromazin, Thorazine, Frenguel, LSD and Analogues to Study the Neurological and Psychiatric Changes Produced

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(U) Project Title: Medical Aspects of CW Warfare

- (4) Date of Initiation: November 1954
  - (5) Date of Expiration: November 1958 (Extension Requested)
  - (6) Amount Funded to Date: \$61,182
  - (7) FY 59 Funding Requirement: \$20,000
  - (8) Principal Investigator: Dr. R. Heath
- d. (1) Contract Title: Methods of Treatment
- (2) Contractor: University of Colorado
  - (3) Scope: To Investigate Methods of Treatment of CW Casualties
  - (4) Date of Initiation: September 1954
  - (5) Date of Expiration: September 1958 (Extension Requested)
  - (6) Amount Funded to Date: \$74,736
  - (7) FY 59 Funding Requirement: \$24,542
  - (8) Principal Investigator: Dr. J. Homes
- e. (1) Contract Title: Treatment of Poisoning by CW Agents
- (2) Contractor: Johns Hopkins University
  - (3) Scope: To Study Mechanism and Treatment of Poisoning by CW Agents
  - (4) Date of Initiation: April 1958
  - (5) Date of Expiration: July 1959
  - (6) Amount Funded to Date: \$54,457
  - (7) FY 59 Funding Requirement: None
  - (8) Principal Investigator: Dr. Johns
- f. (1) Contract Title: Pharmacology of Nerve Gas Poison and Therapeutic Drugs
- (2) Contractor: University of Utah

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(U) Project Title: Medical Aspects of CW Warfare

(3) Scope: Study, Evaluate and Investigate the "Pharmacology of Nerve Gas Poisoning and Therapeutic Drugs"

(4) Date of Initiation: September 1957

(5) Date of Expiration: September 1958

(6) Amount Funded to Date: \$16,553

(7) FY 59 Funding Requirement: None

(8) Principal Investigator: Dr. John R. Ward

g. (1) Contract Title: Psychiatric Studies of Compounds

(2) Contractor: Research Foundation for Mental Hygiene

(3) Scope: Research Services in the Measurement of Psychiatric, Psychological and Special Therapeutic Effects of Certain Compounds

(4) Date of Initiation: September 1957

(5) Date of Expiration: September 1958

(6) Amount Funded to Date: \$25,000

(7) FY 59 Funding Requirement: None

(8) Principal Investigator: Dr. Malitz

h. (1) Contract Title: Neurological Actions of Agents

(2) Contractor: Johns Hopkins University

(3) Scope: Conduct Studies on the Neurophysiological Action of Agents in Clinical Animal Preparations

(4) Date of Initiation: July 1957

(5) Date of Expiration: July 1959

(6) Amount Funded to Date: \$15,000

(7) FY 59 Funding Requirement: \$15,000

(8) Principal Investigator: Dr. Langfit



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(U) Project Title: Medical Aspects of CW Warfare

1. (1) Contract Title: Studies of Clinical Findings from Anticholinesterase Poisoning
- (2) Contractor: Louisiana State University
- (3) Scope: Conduct Studies and Make Recommendations Concerning Clinical Findings of Anticholinesterase Poison
- (4) Date of Initiation: May 1954
- (5) Date of Expiration: July 1958
- (6) Amount Funded to Date: \$56,500
- (7) FY 59 Funding Requirement: None
- (8) Principal Investigator: Dr. C. Petty

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1. (U) Project Title: CW Biological Sciences Research

2. Purpose: Basic and applied research in the biological sciences is necessary for the choice of new agents and new material, for selection of methods for dissemination of chemical agents and for devising techniques for preventing, decontaminating and treating casualties due to chemical agents.

3. Objective: To provide basic toxicological, physiological, pharmacological, entomological and biophysical information required for the development of CW agents and CW offensive and defensive material suitable for use under all environmental conditions.

4. (U) <u>Funding</u> :	<u>Present</u>	<u>Proposed</u>
	\$1245M	\$5610M

5. Scope: This program includes:

a. Pharmacology of CW - Studies have been conducted on adjuncts of atropine, such as oximes, for the treatment of GB and VX poisoning. Studies on the mechanisms of actions of VX and other highly toxic compounds, including those of natural origin, are in progress. Information derived from these studies is the essential pharmacological base for synthesis and selection of new lethal and incapacitating agents and the development of therapeutic and prophylactic drugs.

b. Toxicology of CW Agents - Basic and applied toxicological research is in progress in the following areas: mechanism of penetration of toxic substances through the skin, including the effects of additives; the penetration of toxic substances through clothing employing realistically clothed animals both in the laboratory and in the field; the dosage response to new lethal and incapacitating agents; long-range toxicological explorations, and service work in support of the VX pilot plant.

c. Basic and Applied Physiology - Research on the effects of temperature on actions of VX is in progress. Environmental physiological studies are being continued to determine the protection afforded by the protective mask against the extremes of hot and cold environments. Comparative studies on animals are made to determine the physiological mechanisms involved in their resistance to CW agents. Information derived from these studies is essential for an understanding of the action of CW agents under various climatic conditions and will lead to the development of improved Chemical Corps material, doctrines, and procedures.

d. CW Agent Chemotherapy - New chemotherapeutic compounds are being synthesized. Improved forms of oximes have been made and a search for more effective drugs against G and V agent poisoning is in progress. New screening procedures are also being evaluated.

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(U) Project Title: CW Biological Sciences Research

e. Biophysical Mechanisms of CW Wounds - Studies have been conducted on the properties of wounds caused by toxic fragments and missiles. An improved method of assessing the antipersonnel effects resulting from such fragments has been devised. Biological studies are currently in progress to determine the effectiveness of shaped charge rounds with chemical loading. Basic studies aimed at treatment and prevention of wounds caused by CW munitions are being conducted.

6. Contract Program in Support of this Project:

a. (1) Contract Title: Treatment of Poisoning of CW Agents

(2) Contractor: University of Illinois

(3) Scope: To investigate treatment of poisoning by nerve gases and pulmonary irritants.

(4) Date of Initiation: March 1954

(5) Date of Expiration: December 1958

(6) Amount Funded to Date: \$100,000

(7) FY 59 Funding Requirement: None

(8) Principal Investigator: Dr. Gordon

b. (1) Contract Title: Pharmacology of Certain Compounds

(2) Contractor: University of Michigan

(3) Scope: Conduct research on the pharmacology of certain compounds affecting the central nervous systems of animals and men.

(4) Date of Initiation: January 1955

(5) Date of Expiration: February 1959

(6) Amount Funded to Date: \$41,220

(7) FY 59 Funding Requirement: \$20,000

(8) Principal Investigator: Dr. M. Seevers

c. (1) Contract Title: Barrier to Skin Penetration

(2) Contractor: Western Reserve University

(3) Scope: To determine the nature of intradermal barrier to skin penetration of CW Agents.

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(U) Project Title: CW Biological Sciences Research

- (4) Date of Initiation: June 1958
  - (5) Date of Expiration: June 1959
  - (6) Amount Funded to Date: \$15,000
  - (7) FY 59 Funding Requirement: None
  - (8) Principal Investigator: Dr. Stoughton
- d. (1) Contract Title: Clinical and Experimental Bases for Treating CW Casualties
- (2) Contractor: University of Pennsylvania
  - (3) Scope: Evaluate, in man, drugs or drug mixtures intended for use in preventing or treating casualties produced by V-agents or other related or new CW agents.
  - (4) Date of Initiation: June 1955
  - (5) Date of Expiration: June 1959
  - (6) Amount Funded to Date: \$68,000
  - (7) FY 59 Funding Requirement: \$15,000
  - (8) Dr. J. H. Comroe
- e. (1) Contract Title: Pharmacological Approach to the CW Problem
- (2) Contractor: University of Pennsylvania
  - (3) Scope: Investigate the functional significance of non-neural tissue in the hypothalamic region, study effects of CW agents on transmission of nervous impulses with autonomic ganglia and within the central nervous system, on cardiovascular function, on respiratory activity and on reflex regulatory mechanism of cardiovascular and respiratory functions.
  - (4) Date of Initiation: June 1958
  - (5) Date of Expiration: June 1959
  - (6) Amount Funded to Date: \$35,000
  - (7) FY 59 Funding Requirement: None
  - (8) Principal Investigator: Dr. C. S. Schmidt

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**(U) Project Title: CW Biological Sciences Research**

- f. (1) Contract Title: Penetration into the Skin**  
**(2) Contractor: Massachusetts General Hospital**  
**(3) Scope: Study of spreading of solutions on cutaneous surfaces and penetration of the skin.**  
**(4) Date of Initiation: March 1957**  
**(5) Date of Expiration: February 1959**  
**(6) Amount Funded to Date: \$38,250**  
**(7) FY 59 Funding Requirement: \$20,000**  
**(8) Principal Investigator: Dr. I. H. Blank**

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1. (U) Project Title: Health Hazards of Military Chemicals
2. (U) Purpose: The purpose of this project is to study the toxicological and pharmacological properties of military chemicals such as exotic missile and rocket fuels, exhaust products, hydraulic fluids and lubricants which are required in order to estimate their hazards to man and to develop appropriate treatment and preventive material and procedures.
3. (U) Objective: The objective of this project is to conduct research essential for safeguarding personnel exposed to toxic chemicals such as propellants and oxidizers.
4. (U) Funding:

<u>Present</u>	<u>Proposed</u>
\$10M	\$280M
5. (U) Scope: The scope of this project is to obtain and collate information generated by this program which is of use to the Chemical Corps.
6. (U) Contract Program in Support of this Project: None

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WJTC

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1. (U) Project: CW Protection Research
2. (U) Purpose: The purpose of this project is to assess protective items against CW agents using bio-assay techniques and to discover chemical reactions which are applicable to decontamination procedures and detection and identification methods for CW agents.
3. (U) Objective: The objective of this project is to provide a basis for the development of improved chemical procedures for field detection and decontamination of V and G agents and of new CW agents, as discovered, and for the biological assessment of protective items against such agents.
4. (U) Funding:

<u>Present</u>	<u>Proposed</u>
\$185M	\$640M
5. Scope: This program includes the following:
  - a. CW Aspects of Food and Water - Research is carried out on detection procedures and means of treating contaminated food and water supplies.
  - b. Chemical Aspects of CW Protection - Studies are carried out on basic chemical reactions of V agents for possible leads to detection and decontamination methods for incorporation into kits, crayons, etc.
  - c. Biological Aspects of CW Protection - Developmental CW protective items are evaluated by physiological and toxicological methods under various conditions.
6. (U) Contract Program in Support of this Project:
  - (1) Contract Title: Tertiary Amines and Organohalogenated Agents
  - (2) Contractor: University of Wisconsin
  - (3) Scope: Conduct a research study involving the reactions and kinetics of reactions between varying organohalogenating materials with tertiary amines in aqueous and nonaqueous media.
  - (4) Date of Initiation: June 1958
  - (5) Date of Expiration: June 1960
  - (6) Amount Funded: \$19,000
  - (7) FY 1959 Funding Requirements: None
  - (8) Principal Investigator: Dr. Higuchi

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1. (U) Project Title: Packaging and Materials Research
2. (U) Purpose: Military supply with its emphasis on concepts such as aerial delivery require specialized attention to packaging and packing and a continuing effort to keep pace with latest and best developments in this field. A strong materials research effort is needed to meet current requirements and to compile knowledge in anticipation of future materials needs for CBR materiel.
3. (U) Objective: To conduct a research and development program on packaging and engineering materials that will promote maximum effectiveness in CmlC materiel and minimum cost.
4. (U) Funding:

	<u>Present</u>	<u>Proposed</u>
	\$90M	\$370M
5. (U) Scope: This program includes the following:
  - a. Packaging Research for CmlC Materiel - Emphasis is being placed on development of specific end-item packaging such as CW warheads for missiles, CW alarms, etc. By providing engineered packaging and packing for CmlC materiel it is assured that this materiel will be serviceable from the time of production to the time of use.
  - b. Materials Research for CmlC Materiel - Emphasis will continue on resolving specific material problems consistent with end-item development. The use of more efficient and economical materials in CmlC end items permits better design concepts and facilitates their manufacture.
6. (U) Contract Program in Support of this Project: None

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1. **Project Title:** Large Area Particulate Cloud Travel (LAC) (U)
2. **Purpose:** Calculations and preliminary tests have indicated that it is possible to attack very large areas, 100,000 square miles or greater, with BW agents. Further testing is required to quantitate this concept and to determine both the potentiality of large scale BW attacks and the vulnerability of the U. S. to such attacks.
3. **Objective:** The objectives of this project are to determine the distribution of biological agents achieved over areas of several hundred thousand square miles by disseminating materials along an extended line source and to obtain definitive data for the verification of predictive meteorological concepts relating to air mass trajectories and downwind diffusion of particulates.
4. (U) **Funding:**

<u>Present</u>	<u>Proposed</u>
\$200M	\$322M
5. **Scope:** A series of exploratory trials have been conducted using extended line sources (400 miles and greater). Fluorescent particles were released in amounts up to 5,000 lbs. per trial. The particulates were dispersed over an area in the order of 300,000 square miles, establishing the feasibility of this concept. Additional trials are being conducted to obtain quantitative data on area coverage using this method of particulate dispersal under a variety of meteorological conditions. Increased effort is being given to improving the stability of BW agents and developing appropriate disseminating devices for test purposes. Models for predicting particulate cloud diffusion and area coverage are being developed.
6. (U) **Contract Program in Support of this Project:** None

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WABC

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1. (U) Project Title: Cloud Physics of Toxicological Warfare
2. (U) Purpose: Effective operational use of toxic CW and BW munitions by the field commander requires (1) the ability to predict target effectiveness, (2) the ability to predict target meteorology, and (3) reliable estimates of the potential hazard to friendly troops. Efficient, economical, and reliable field testing of toxic CW and BW munitions necessitates an understanding of the basic parameters governing atmospheric turbulence and diffusion. This project encompasses the essential field trials, data evaluation, and theoretical studies, to meet the above requirements.
3. (U) Objective: The objective of this project is (1) to develop information concerning basic parameters of turbulence, (2) to form mathematical predictive equations for concentration and dosage calculations to improve the theoretical basis for field testing, and (3) to provide the essential tools for field combat use of toxic munitions systems.
4. (U) Funding:

<u>Present</u>	<u>Proposed</u>
\$300M	\$3000M
5. (U) Scope: This program includes:
  - a. Complex Terrain Studies - Studies have been initiated to investigate the diffusion of gaseous and particulate clouds over special surface situations such as (1) tropical jungle and rain forest, (2) mountainous regions and broken terrain, (3) open sea, and (4) arctic terrain.
  - b. Meteorological Research in Support of the LAC Program - Studies on vertical winds gustiness with height and diffusion of particulates for downwind distances up to 200 miles under night time conditions are in progress.
  - c. Investigation of Meteorological Parameters and Forecasting for Operational Employment - Improved methods are being developed for operational meteorological forecasting.
  - d. Investigation of Diffusion from Point Sources - This program is designed to provide data on the downwind distribution of material of a distance of 0-1 and 0-10 miles over flat terrain under a wide range of meteorological conditions. Data will be used to verify and/or modify mathematical models that have been developed for estimating BW and CW casualties.

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(U) Project Title: Cloud Physics of Toxicological Warfare

6. Contract Program in Support of this Project:

(1) Contract Title: Characterization of Air Flow Patterns

(2) Contractor: Stanford University

(3) Scope: The scope includes participation in planning, executing and evaluating of field experiments designed to compare atmospheric diffusion prediction equations over flat open terrain, to continue cloud physics instrumentation work, and to provide assistance in development and advancement of CER test technology specifically as it pertains to FP tracer techniques.

(4) Date of Initiation: June 1955

(5) Date of Expiration: June 1959

(6) Amount Funded To Date: \$320,329

(7) FY 59 Funding Requirement: \$85,000

(8) Principal Investigator: Dr. W. Perkins

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W220

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1. (U) Project Title: Ecology and Epidemiology, DPG
2. (U) Purpose: The purpose of this project is to continuously investigate the safety limits and conditions for field testing BW materials in order to safeguard the health of animal and human populations of the Dugway test area.
3. (U) Objective: The objective of this project is to identify the insect, animal and bird population of the Dugway Proving Ground and determine the diseases endemic in them and the diseases to which they are susceptible, with particular emphasis on the agents to be utilized at DPG.
4. (U) Funding:

<u>Present</u>	<u>Proposed</u>
\$185M	\$640M
5. Scope: This program includes:
  - a. Research on Fauna in Field and Laboratory (Ecological Phase). Research in the transmission of disease by wildlife with particular emphasis to those BW agents to be tested at DPG.
  - b. Survey of Livestock and Wildlife (Epidemiological Phase). Surveys are conducted on infectious diseases in livestock and wildlife to determine current endemic disease situations and to determine any effects of BW field trials.
6. Contract Program in Support of this Project:
  - a. (1) Contract Title: Epidemiology Survey of the Region in and around Dugway Proving Ground, Dugway, Utah.
  - (2) Contractor: University of Utah
  - (3) Scope: Conduct continuous investigation relative to the safety limits and conditions for field testing toxic BW materials in order to safeguard the health of animal and human populations of the test areas.
  - (4) Date of Initiation: September 1957
  - (5) Date of Expiration: September 1959
  - (6) Amount Funded to Date: \$90,290
  - (7) FY 59 Funding Requirement: \$57,000
  - (8) Principal Investigator: Dr. Jager

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(U) Project Title: Ecology and Epidemiology, DPG

- b. (1) Contract Title: Ecological Research Studies on Evaluating Wildlife in Relation to Spread of BW Agents
- (2) Contractor: University of Utah
- (3) Scope: The objective is to perform continuing research on fauna in and around DPG in the field and laboratory to provide the basis for predictions of public health impact on specific BW field testing programs.
- (4) Date of Initiation: June 1958
- (5) Date of Expiration: June 1959
- (6) Amount Funded to Date: \$290,924
- (7) FY 59 Funding Requirement: \$91,000
- (8) Principal Investigator: None

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WARC

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1. (U) Project Title: CBR Field Test Technology
2. (U) Purpose: To provide the technological research essential to the development of techniques for efficient, significant and accurate field sampling and assessment of CBR munition and agent dissemination trials.
3. (U) Objective: To provide a sustaining and critical evaluation of techniques, methods and equipment utilized in CBR field testing in order to improve existing knowledge and capability in this field.
4. (U) Funding:

<u>Present</u>	<u>Proposed</u>
\$250M	\$1120M
5. Scope: This program includes:
  - a. CW Field Test Technology - This program will provide for development of essential analytical procedures, collection techniques, and evaluation techniques required for the accomplishment of field testing in the CW munitions program with current emphasis on the V-filled items.
  - b. BW Field Test Technology - This program will provide for the development of techniques in collection, assessment, and evaluation of BW agents disseminated in various experimental munitions and devices.
6. (U) Contract Program in Support of This Project: None

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1. (U) Project Title: BW Warheads for Rockets and Missiles
2. (U) Purpose: The purpose of this project is to satisfy a requirement for application of BW items to missile warheads for U.S. Army. This will provide an integrated BW capability for U.S. Army shown by operational studies to have important advantages in various military situations.
3. (U) Objective: To develop a BW weapons system for missile delivery.
4. (U) Funding:

	<u>Present</u>	<u>Proposed</u>
	\$150M	\$992M
5. Scope: A BW warhead for SERGEANT Missile is being designed and several prototypes fabricated and tested. Upon completion, this item will give the Army a BW capability utilizing the SERGEANT Missile.
6. Contract Program in Support of this Project:
  - (1) Contract Title: Preliminary Research and Development of a Missile Warhead.
  - (2) Contractor: Aerojet-General Corporation
  - (3) Scope: To develop a satisfactory BW Warhead for delivery and release of BW agent bomblets (SERGEANT Missile).
  - (4) Date of Initiation: April 1958
  - (5) Date of Expiration: November 1958 (Extension being negotiated)
  - (6) Amount Funded to Date: \$108,730
  - (7) FY 1959 Funding Requirement: \$113,480
  - (8) Technical Supervisor: Mr. S. Fabek

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WTRC



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1. (U) Project Title: Special BW Operations
2. (U) Purpose: The adaptation of BW to special operations requires research and development to establish both offensive and defensive capability in this area.
3. (U) Objective: To provide materiel and techniques applicable to special offensive and defensive BW operations.
4. (U) Funding:

<u>Present</u>	<u>Proposed</u>
\$400M	\$643M
5. Scope: Provision of BW materiel and techniques for special operations which will provide a new capability in warfare. Details of this project are TOP SECRET.
6. Contract Program in Support of This Project:
  - a. (1) Contract Title: Studies and Investigations of the Factors Affecting the Pathogenicity of Salmonella
  - (2) Contractor: University of Wisconsin
  - (3) Scope: Conduct requested studies of the factors affecting the pathogenicity of Salmonella
  - (4) Date of Initiation: February 1955
  - (5) Date of Expiration: February 1959
  - (6) Amount Funded to Date: \$82,600
  - (7) FY 59 Funding Requirement: None
  - (8) Principal Investigator: Mr. J. V. Wilson
  - b. (1) Contract Title: Preparation and Evaluation of Staphylococcal Enterotoxoids
  - (2) Contractor: University of Chicago
  - (3) Scope: Develop and evaluate toxoids from partially purified staphylococcus enterotoxin preparations
  - (4) Date of Initiation: May 1956
  - (5) Date of Expiration: January 1959
  - (6) Amount Funded to Date: \$56,200
  - (7) FY 59 Funding Requirement: None

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(U) Project Title: Special BW Operations

(8) Principal Investigator: Dr. Gail M. Dack

c. (1) Contract Title: Investigation of Immunization Against Coccidioides immitis

(2) Contractor: Duke University

(3) Scope: Conduct necessary investigation of vaccine preparations against Coccidioides immitis

(4) Date of Initiation: July 1956

(5) Date of Expiration: September 1960

(6) Funded to Date: \$28,800

(7) FY 59 Funding Requirement: None

(8) Principal Investigator: Dr. Norman S. Conant

d. (1) Contract Title: Investigations Concerning the Pathogenicity and Physiology of the Genus Cryptococcus

(2) Contractor: University of West Virginia

(3) Scope: Conduct studies and tests relative to the pathogenicity and physiology of the genus Cryptococcus

(4) Date of Initiation: August 1956

(5) Date of Expiration: July 1959

(6) Amount Funded to Date: \$33,860


(7) FY 59 Funding Requirement: None

(8) Principal Investigator: Dr. John Slack

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1. (U) Project: BW Munitions Development
2. (U) Purpose: To develop BW munitions which can be delivered by current and future weapons systems of the Armed Forces.
3. (U) Objective: The objective of this project is to develop BW munitions which will enable the field army to utilize BW weapons in the most effective manner and which will provide a powerful weapon of a characteristic not found in other weapons.
4. (U) Funding:

<u>Present</u>	<u>Proposed</u>
\$385M	\$1050M
5.  Scope: The tasks under this project are as follow:
  - a. Portable Biological Generator - This is a development task to develop a BW munition which can be used by troops in forward areas. Such a munition will provide the field soldier with a weapon for use in certain tactical situations in which conventional weapons would be of little use.
  - b. 3.4 Spherical BW Bomblat - This bomblat is of the self-dispersing type and will enable the most effective delivery of BW agents from guided missiles and aircraft. This bomblat is in the advanced design stages and has been successfully delivered by supersonic test vehicles.
  - c. Assessment of BW Munitions - During the development of BW munitions, the various designs must be tested and the BW effectiveness must be carefully measured and evaluated. Special methods and techniques must be devised in order to accomplish this task.
6. (U) Contract Program in Support of this Project: None

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WARG

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1. (U) Project Title: BW Product and Process Engineering
2. (U) Purpose: It is essential that optimum process equipment and product design criteria and designs be developed to implement an active BW production program whenever the need may arise.
3. (U) Objective: To develop complete, up-to-date designs and specifications for BW production processes, equipment and products.
4. (U) Funding:

	<u>Present</u>	<u>Proposed</u>
	\$205M	\$824M
5. Scope: This program includes the following:
  - a. Preparation of Drawings and Purchase Descriptions - Drawings and purchase descriptions will be available to procure item for Final Engineering Test (e.g., E-22 Generator, E-133 Sphere, E-25 BW Field Sampling Kit).
  - b. Engineering Studies - Knowledge of latest advances in engineering techniques is maintained enabling application to the BW program resulting in solution of unique R&D problems.
6. (U) Contract Program in Support of this Project:
  - (1) Contract Title: Standardized Biological Safety Cabinets
  - (2) Contractor: Aerojet-General Corporation
  - (3) Scope: Produce complete set of production fabrication drawings and models for safety hoods and parts for use in producing antipersonnel agents for use in BW.
  - (4) Date of Initiation: July 1957
  - (5) Date of Expiration: September 1958
  - (6) Amount Funded: \$98,000
  - (7) FY 1959 Funding Requirements: None
  - (8) Principal Investigator: Mr. Harold P. Feldman

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1. (U) Project Title: BW Agent Process Development
2. Purpose: A reliable, evaluated process for producing agents in large quantities is essential for a lethal or incapacitating BW weapons systems.
3. Objective: The objective of this project is to develop economically desirable and technologically feasible methods for producing BW agents which meets specific technical requirements.
4. (U) Funding:

<u>Present</u>	<u>Proposed</u>
\$773M	\$2500M
5. Scope: This program includes the following:
  - a. Process Development of Dry P. Tularensis (UL) - A production process will be demonstrated in pilot plant equipment for the production of dry UL and the product evaluated for aerobiological properties.
  - b. Process Development of Wet Venezuelan Equine Encephalomyelitis (NU) Pilot plant development of Agent NU in eggs will be completed. Work will include aerobiological properties of wet NU. This work will result in obtaining the information required to establish a production capability.
  - c. Assessment for BW Process Development - Reliability of processes for dry UL and wet NU will be evaluated in test spheres and chambers using test fixtures and prototype munitions. Aerobiological properties of the dry agents will be assessed.
6. (U) Contract Program in Support of this Project: None

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1. (U) Project Title: Anticrop Warfare

2. Purpose: To perform research on plant pathogens, and chemical anticrop agents which would result in a serious loss of agricultural commodities to the extent that the ability of an enemy to wage war would be seriously affected.

3. Objective: To provide effective agents which will attack enemy agricultural commodities.

4. (U) <u>Funding:</u>	<u>Present</u>	<u>Proposed</u>
	\$200	\$2000M

5. Scope: This program includes research on cereal agents, rice pathogens and anti-rice chemicals, screening of new biological anti-crop agents including viral types, epidemiological studies on potential target areas, research to determine practical anticrop agent dissemination techniques and equipment suitable for field testing and potential operational applications.

6. Contract Program in Support of This Project: None. This project was previously cancelled due to lack of funds and has just been re-established by the Department of the Army.

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1. (U) Project Title: CW Warheads for Rockets and Missiles
2. Purpose: To enable tactical units to neutralize effectively both point and large area targets by use of large rockets and guided missiles for delivery of CW agents.
3. Objective: To develop the most effective chemical warfare capability by exploiting the potential of chemical agents in surface-to-surface missiles and larger rockets.
4. (U) Funding:

<u>Present</u>	<u>Proposed</u>
\$1515M	\$2900M
5. Scope: This program includes:
  - a. GB Warheads for HONEST JOHN Rocket - This covers development of a CW warhead for the HONEST JOHN Rocket and evolving data necessary for design of a warhead compatible with the Improved HONEST JOHN Rocket within the time frames that the respective rockets will remain in the Army system.
  - b. CW Warhead Studies for Guided Missiles - This covers the conduct of studies and investigations of basic principles to guide development of CW warheads of maximum target effectiveness for Army rockets and guided missiles. Studies have been made of the suitability for CW use of the LITTLE JOHN, REDSTONE, JUPITER, and LACROSSE type missiles, and an investigation is being made of the suitability of use of massive warheads for point targets and bomblets for larger targets.
  - c. GB Warhead for Optimum LITTLE JOHN Rocket - This covers development of a warhead to provide the Army with a flexible capability to neutralize both point and area targets.
  - d. GB Warhead for SERGEANT Missile - This covers development of a warhead to provide the field Army with a CW capability to strike targets in rear areas.
6. (U) Contract Program in Support of This Project:
  - a. (1) Contract Title: Field Testing of Warheads
  - (2) Contractor: New Mexico A&M College
  - (3) Scope: Performs the service of collecting, assembling, and evaluating the data obtained as the result of actual missile firings at White Sands Proving Ground.
  - (4) Date of Initiation: 4 December 1956
  - (5) Date of Expiration: December 1958

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(U) Project Title: CW Warheads for Rockets and Missiles

- (6) Amount Funded to Date: \$51,845
  - (7) FY 59 Funding Requirement: \$36,000
  - (8) Principal Investigator: Mr. E. McDowell
- b. (1) Contract Title: Experimental Pyrotechnic and Explosive Development and Loading Devices
- (2) Contractor: Atlas Powder Company
  - (3) Scope: To develop and conduct tests of various pyrotechnic and/or explosive components to include: - (a) gas generator pyrotechnic components, (b) pyrotechnic delay and explosive bolt assemblies, and (c) linear shaped charges
  - (4) Date of Initiation: June 1958
  - (5) Date of Expiration: June 1959
  - (6) Amount Funded to Date: \$15,000
  - (7) FY 59 Funding Requirement: None
  - (8) Principal Investigator: Mr. R. Girr
- c. (1) Contract Title: Fabrication of Warhead Casings
- (2) Contractor: Aircraft Armaments
  - (3) Scope: To design, develop and fabricate ten test warhead casings for CORPORAL Missiles
  - (4) Date of Initiation: June 1956
  - (5) Date of Expiration: July 1959
  - (6) Amount Funded to Date: \$99,614
  - (7) FY 59 Funding Requirement: \$10,000
  - (8) Principal Investigator: Mr. W. Birchman

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(U) Project Title: CW Warheads for Rockets and Missiles

- d. (1) Contract Title: Warheads for SERGEANT Missiles
- (2) Contractor: Cook Electric Company
- (3) Scope: To design and fabricate chemical warhead for SERGEANT Missile
- (4) Date of Initiation: June 1957
- (5) Date of Expiration: December 1958
- (6) Amount Funded to Date: \$110,999
- (7) FY 59 Funding Requirement: \$25,886
- (8) Principal Investigator: Mr. C. F. Bilinski

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1. (U) Project Title: Flame Warfare Materiel
2. (U) Purpose: US CONARC and the U.S. Marine Corps have firm requirements for materiel and related equipment for effective conduct of flame warfare.
3. (U) Objective: To develop improved portable and mechanized flame throwers, flame thrower service equipment, incendiary agents, flame thrower fuels and fuel thickeners.
4. (U) Funding:

	<u>Present</u>	<u>Proposed</u>
	\$240M	\$627M
5. (U) Scope: This program includes the development of the following flame warfare items of materiel which are scheduled for standardization within the next two years.
  - a. Flame thrower, for AUV/APC Class Vehicles - This item will give a flame capability to a new family of light weight vehicles.
  - b. Improved Portable Flame Thrower - This item is 1/3 less the weight of present standard flame throwers, has improved filling and servicing characteristics, and better silhouette characteristics. In addition, it will extend the range of portable flame throwers to 100 meters.
  - c. Flame fuels and thickeners - An improved fuel thickener of polybutadiene rubber is under development. This thickener is superior to present thickeners for production of more stable fuels with better mixing and operational characteristics, and will be usable in all current flame prototypes and standard flame materiel.
  - d. R42 Fire Rocket - Final Engineering Tests are being conducted on a flame rocket that will give the ground forces a close support weapon for employment of flame on area targets at ranges of 400 to 2500 meters. Present flame capabilities are limited to a range of 300 meters.
  - e. Fuel Mixing and Transfer Unit - An improved fuel mixing and transfer unit is under development which will be of continuous type and will permit servicing of portable and mechanized flame throwers at a markedly increased rate with less maintenance.
6. (U) Contracts in Support of this Project: None

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1. (U) Project Title: Toxic CW Munitions

2. (U) Purpose: To develop the most effective chemical warfare capability in both aerial and ground delivery munitions.

3. (U) Objective: Requirements exist to develop the most effective toxic chemical munitions for delivery by current and future aerial and ground weapon systems and which will enable the Armed Forces to have the best toxic chemical offensive capability in readiness.

4. (U) <u>Funding:</u>	<u>Present</u>	<u>Proposed</u>
	\$1210M	\$2910M

5. Scope: This program includes the following:

a. Techniques for Field Evaluation of CW Munitions - This task is to develop the necessary techniques for the proper testing and evaluation of V-agent and V-agent munitions.

b. V-Agent Munitions - This task is to develop munitions which will disseminate V-agents in the most effective manner and provide a capability for delivery of V-agent by current and future weapons systems. Such munitions include the 4 1/2" spherical self-dispersing munition for use in Army guided missiles such as the LITTLE JOHN, HONEST JOHN, and SERGEANT; V-agent shells for the 105mm, 155mm and 8" Howitzers, the V-agent toxic landmine, and the T-238 Area Toxic Rocket Weapon System. Feasibility studies are also being conducted on V-agent spray tanks to be carried by USAF and Naval aircraft and Army drones. Other feasibility studies are being conducted on massive cube bombs for the delivery of GB and V-agents by USAF strategic bombers. Although not funded by Army, GB shells are being developed for 5" and 6" Naval guns as well as a 500-lb. GB bomb for naval aircraft delivery.

c. Other tasks under this project are the development of special riot control devices for the Military Police such as the Helicopter-Mounted Irritant Gas Dispenser, the Portable Irritant Gas Dispenser, and a bursting-type Irritant Gas Grenade.

6. Contract Program in Support of this Project:

a. (1) Contract Title: Bomb Bay Spray Tank

(2) Contractor: EDO Corporation

(3) Scope: To determine the feasibility of a bomb bay spray tank for use with CW agents.

(4) Date of Initiation: July 1957

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Project Title: Toxic CW Munitions

- (5) Date of Expiration: January 1960
  - (6) Amount Funded: \$116,600
  - (7) FY 1959 Funding Requirements: None
  - (8) Principal Investigator: Mr. Donald Shapero
- b. (1) Contract Title: Development of Self-Dispersing Rotor
- (2) Contractor: The Flettner Aircraft Company
  - (3) Scope: Development of self-dispersing rotor.
  - (4) Date of Initiation: April 1958
  - (5) Date of Expiration: December 1958
  - (6) Amount Funded: \$37,000
  - (7) FY 1959 Funding Requirements: None
  - (8) Principal Investigator: Mr. A. Flettner
- c. (1) Contract Title: Wind Tunnel Testing
- (2) Contractor: National Bureau of Standards
  - (3) Scope: Conduct wind tunnel studies of the aerodynamic characteristics of Chemical Corps aerial munitions.
  - (4) Date of Initiation: January 1958
  - (5) Date of Expiration: May 1959
  - (6) Amount Funded: \$11,000
  - (7) FY 1959 Funding Requirements: \$10,000
  - (8) Principal Investigator: Mr. R.H. Heald
- d. (1) Contract Title: Encapsulation Materials for Utilization of CW.
- (2) Contractor: University of Michigan
  - (3) Scope: To investigate various encapsulation materials and techniques for utilization in CW.

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Project Title: Toxic CW Munitions

- (4) Date of Initiation: June 1958
  - (5) Date of Expiration: June 1959
  - (6) Amount Funded: \$1.00
  - (7) FY 1959 Funding Requirements: \$1.00
  - (8) Principal Investigator: Dr. A. Mattocks
- e. (1) Contract Title: Theoretical Investigation of Gas Behavior
- (2) Contractor: New York University
  - (3) Scope: To conduct theoretical investigation of gas behavior as related to casualty production and munition effectiveness.
  - (4) Date of Initiation: June 1957
  - (5) Date of Expiration: August 1959
  - (6) Amount Funded: \$40,000
  - (7) FY 1959 Funding Requirements: \$20,000
  - (8) Principal Investigator: Mr. L. Harbach

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1. (U) Project Title: Signalling and Screening Smokes
2. (U) Purpose: US CONARC has stated requirements for countermeasures against visual, infrared and radar observation and for protection against thermal effects of atomic weapons.
3. Objective: To improve smoke signalling and screening systems capable of being used by the Army in support of both offensive and defensive combat operations.
4. (U) Funding:

<u>Present</u>	<u>Proposed</u>
\$25M	\$66M
5. Scope: Studies are in progress on methods for the generation of screening agents which will serve as countermeasures against visual, infrared and radar battlefield observation. Maximum protection against the thermal effects of atomic weapons is also included.
6. (U) Contract Program in Support of this Project: None

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1. (U) Project Title: Engineering Design, Specifications and Testing
2. (U) Purpose: In order to assure mass producibility of CW items under development, it is necessary that required engineering be performed throughout development. Drawings and purchase descriptions, including surveillance criteria are required for procurement of prototypes for final engineering tests.
3. (U) Objective: Perform engineering to assure mass producibility, prepare final prototype drawings and procurement purchase descriptions of Chemical Corps materiel and conduct engineering studies.
4. (U) Funding:

	<u>Present</u>	<u>Proposed</u>
	\$255M	\$855M
5. (U) Scope: This program includes the following:
  - a. Engineering Design and Testing - Engineering studies are being conducted on subjects such as modern metal forming techniques, decontamination of air filters, powered metal process and equipment.
  - b. Product Design and Drawings - Drawings are being prepared on all items on which prototypes will be provided for Final Engineering Tests (e.g., E-37 Tank Collective Protector, 8" Howitzer GB, HONEST JOHN Rocket).
  - c. Purchase Descriptions and Environmental Surveillance Criteria - Purchase descriptions are being prepared for Engineering Test procurement and criteria are being established for items entering Environmental Test Program.
6. (U) Contract Program in Support of this Project: None

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1. (U) Project Title: CW Agent Process Development
2. (U) Purpose: This project covers the research studies and process investigations for the development of new CW agents and processes including: (a) the accumulation of basic research process information and data; (b) special investigations to improve unit synthesis and techniques; and (c) the synthesis of trial lots of agents and agent intermediates for munition development test program.
3. (U) Objective: The objective of this project is to conduct process research and develop new and improved processes, equipment and operational techniques for the manufacture of CW agents and intermediates.
4. (U) Funding:

	<u>Present</u>	<u>Proposed</u>
	\$360M	\$4500M
5. Scope: - Research studies and investigations will be carried out to determine the basic factors pertaining to intermediate stability and purification and to determine process data. Information developed under this program will assure that Chemical Corps will be able to fulfill its mission of maintaining up-to-date process research data and information required to provide agent and munition capability.
6. Contract Program in Support of This Project:
  - a. (1) Contract Title: Process Studies of V-agent
  - (2) Contractor: M. W. Kellogg Company
  - (3) Scope: This contract has as its objective the definition of the reactions for the efficient production of VX agent using the Transester Process.
  - (4) Date of Initiation: May 1958
  - (5) Date of Expiration: July 1959
  - (6) Amount Funded: \$212,695
  - (7) FY 1959 Funding Requirements: \$12,476
  - (8) Principal Investigator: L. B. Coggin

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1. (U) Project Title: CW Warning and Detection

2. Purpose: Human senses are ineffective for warning of the presence of the new CBR agents. In addition, the extreme toxicity of these agents dictates that rapid warning devices be available which are capable of permitting personnel to take protective measures prior to exposure to incapacitating or fatal dosages. Also, detection methods and kits are required (1) to determine when it is safe to remove protection, (2) to delineate areas contaminated, and (3) to identify specific agents used.

3. Objective: To develop rapid warning systems for the Armed Forces permitting employment of protective measures before enemy use of CBR agents becomes effective, and to devise identification systems which can identify the specific agent used in an attack.

4. (U) <u>Funding:</u>	<u>Present</u>	<u>Proposed</u>
	\$465M	\$1600M

5. Scope: This program includes:

a. Toxicological Area Screening Alarms - A priority research effort is being conducted towards the development of an item capable of immediate warning of the presence of toxic gas clouds prior to their infiltration of a military operation. A "breadboard" model of a device called LOPAIR utilizing the infrared principle has been constructed and tested with encouraging results.

b. Detection Methods and Materials for Toxic Agents - Research is being conducted on chemicals and their reaction for use in papers, powders, paints and crayons to detect V and G agents. The results from these investigations will form the basis for the development of new items superior to existing detection and identification devices.

c. Developmental Items - The following items are presently under development:

- (1) Toxic Agent Point Source Alarm
- (2) CW Agent Detector Crayon
- (3) CBR Agent Sampling and Analyzing Kit

6. Contract Program in Support of this Project:

- a. (1) Contract Title: Test for V-Agent
- (2) Contractor: Batelle Memorial Institute
- (3) Scope: Investigation of Laboratory Tests for V-Agents

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(U) Project Title: CW Warning and Detection

- (4) Date of Initiation: May 1956
  - (5) Date of Expiration: Extension has been requested
  - (6) Amount Funded to Date: \$114,400
  - (7) FY 59 Funding Requirement: \$40,000
  - (8) Principal Investigator: Dr. R. Poirier
- b. (1) Contract Title: LOPAIR Alarm
- (2) Contractor: Farrand Optical Company
  - (3) Scope: Development and construction of a fixed installation LOPAIR Alarm
  - (4) Date of Initiation: January 1957
  - (5) Date of Expiration: December 1958
  - (6) Amount Funded to Date: \$33,475
  - (7) FY 59 Funding Requirement: None
  - (8) Principal Investigator: Mr. R. Adler
- c. (1) Contract Title: Miniaturized E21 Alarm
- (2) Contractor: Radio Corporation of America
  - (3) Scope: To miniaturize the E21 Point Source Alarm
  - (4) Date of Initiation: December 1954
  - (5) Date of Expiration: February 1959
  - (6) Amount Funded to Date: \$163,950
  - (7) FY 59 Funding Requirement: None
  - (8) Principal Investigator: J. R. Parsons
- d. (1) Contract Title: LOPAIR System
- (2) Contractor: Eastman Kodak Company

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(U) Project Title: CW Warning and Detection

- (3) Scope: Investigations of LOPAIR Systems for Determination of Toxic Agents
- (4) Date of Initiation: June 1955
- (5) Date of Expiration: April 1959
- (6) Amount Funded to Date: \$129,050
- (7) FY 59 Funding Requirement: None
- (8) Principal Investigator: Mr. C. D. Salzberg

e. (1) Contract Title: LOPAIR System

- (2) Contractor: Farrand Optical Company
- (3) Scope: Conduct Studies on Improved LOPAIR Alarm, E-33
- (4) Date of Initiation: October 1955
- (5) Date of Expiration: October 1958
- (6) Amount Funded to Date: \$106,692
- (7) FY 59 Funding Requirement: None
- (8) Principal Investigator: D. P. Nolan

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1. (U) Project Title: Nuclear Warfare Defense
2. Purpose: To obtain the information on radiation, either initial or residual, required to develop the procedures, techniques and equipment needed to cope with the radiological hazards incident to nuclear warfare. This information must be of a type and in a form suitable for use by military planners.
3. Objective: To provide the information, techniques and equipment required by the Army for defense against the radiological hazards incident to nuclear warfare. These hazards may be from the initial or residual radiation from a nuclear weapon and/or the radiation from radiological warfare agents.
4. (U) Funding:

	<u>Present</u>	<u>Proposed</u>
	\$570M	\$2250M
5. Scope: This program includes:
  - a. Protection Against Radiological Hazards - The determination of the neutron cross sections of various elements important for use in military shielding and construction are being conducted jointly with the National Bureau of Standards. Neutron scattering, absorbing and reflecting experiments over and through various media are being conducted as an inhouse program. This program must be correlated closely with the gamma radiation, the building of gamma radiation within an absorbing medium, and the development of data for use by designers of equipment and fortifications to incorporate the optimum gamma shielding characteristics consistent with other requirements.
  - b. Atomic Weapons Test Participation - Planning is continuing for participation in atomic weapons tests when the current moratorium expires. This includes the measurements of both gamma and neutron radiation as a function of both time and distance and the determination of the spectrum.
  - c. Technical Evaluation and Review - The U.S. has detonated approximately 150 nuclear weapons and devices, ranging from a few tons to several megatons yield and wide variations in height (or depth) bursts. These data must be correlated and put into useable form and the probable accuracy determined. This work is expected to show where additional work is needed or where further work is not needed and put available data into a form useable by non-technically trained personnel.
  - d. Tactical Gamma-Neutron Dosimeter - This work covers the development of a dosimeter which will record both the neutron and gamma doses received, either singly or combined.

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(U) Project Title: Nuclear Warfare Defense

e. Special RW Projects - Work in offensive employment of radiological warfare agents which has been limited to review of current and projected stock pile of fission products from US and NATO reactors, is continuing.

f. Radiation Test Area and Particle Accelerator - A circular radiation test area with a 100 yard radius is presently under construction. This radiation field will be used for gamma shielding problems, biological experiments, instrument calibration and development, and development of monitoring and survey techniques. Negotiations are underway at the present time for the purchase of a particle accelerator for use in the neutron program. This accelerator will give a controlled source of neutrons of various energies and will be of great use in the neutron field.

6. Contract Program in Support of This Project:

a. (1) Contract Title: Gamma Neutron Dosimeter

(2) Contractor: Controls for Radiation Incorp.

(3) Scope: To design, fabricate and test suitable equipment for the fabrication of tactical chemical dosimeters. Contractor will conduct kinetic studies and isolate and identify quantitatively the radiolysis products using both types of radiation.

(4) Date of Initiation: June 1958

(5) Date of Expiration: May 1959

(6) Amount Funded: \$80,087

(7) FY 1959 Funding Requirements: \$55,657

(8) Principal Investigator: Mr. I. Bernstein

1. (U) Project Title: Combat Surveillance Countermeasures (Non-Electronic)
2. Purpose: Great emphasis is being placed by the Armed Forces in the use of photographic, radar, and infrared devices to obtain information on enemy movements. Since the enemy will have a similar capability, countermeasures against these devices are necessary to protect our own forces. Non-electronic, or physical countermeasure agents are often more effective than electronic countermeasures for jamming, or rendering ineffective, such battlefield surveillance devices.
3. Objective: To discover and develop, non-electronic principles, agents, and dissemination systems aimed at reducing the effectiveness of enemy visual, photographic, radar, and infrared battlefield surveillance devices.
4. (U) Funding:

<u>Present</u>	<u>Proposed</u>
\$60M	\$230M
5. Scope: There are three tasks under this project which are supported by approved requirements from the field army. These tasks are:
  - a. Screening Agents Research: This task is to discover new and improved non-electronic screening agents and methods of dissemination of such agents.
  - b. Infrared Screening Systems: This task is to develop a suitable agent and disseminating system which will provide protection against enemy infrared surveillance systems. There is an approved requirement from the army field forces for this countermeasure system and an agent has been found (E16) which is quite effective. At present, a new gas turbine disseminator is being developed which will provide protection of troops and armor over large areas from enemy photographic, visual and infrared surveillance systems.
  - c. Radar Screening Systems: This task is to develop a suitable agent and disseminating system which will provide protection against enemy radar surveillance systems. There is an approved requirement from the army field forces for this countermeasure system. An agent has been developed (E10) which is effective against the most commonly used radar surveillance wavebands and development is being initiated to provide disseminators such as 81 mm and 4.2" mortar shells for protection of forward troops against enemy radar locators, and various high-altitude rockets to protect guided missile battalions from enemy radar surveillance. Work is continuing to develop a new screening agent which will be equally effective at the extremely short radar bands now coming into use for surveillance purposes.
6. (U) Contract Program in Support of This Project: None

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1. (U) Project Title: CW-BW Protective Materiel

2. (U) Purpose: The purpose of this project is to develop protective materiel and procedures which are compatible with present and proposed operational doctrine and techniques and that are required to enable Army units in the field to accomplish their mission under conditions of CBR warfare.

3. Objective: The objectives of this project are to develop effective decontamination systems, protective masks and components, new and improved clothing and clothing finishes and collective protection materiel which will satisfy existing requirements for BW-CW protective materiel.

4. (U) <u>Funding:</u>	<u>Present</u>	<u>Proposed</u>
	\$900M	\$3100M

5. Scope: This program includes the following:

a. Protective Clothing - Search for a clothing impregnation system which is reactive, repellent and self-indicating for nerve and vesicant type agents which will provide effective protection against highly toxic agents which cause casualties through skin penetration.

b. Decontamination Methods and Materiel - Development of E17R1 Portable Decontaminating Apparatus and DS-2 Solution. Studies on an individual decontaminating kit. Search for improved decontamination procedures and materials.

c. Collective Protection for Guided Missile Control Vans - Development of protectors for NIKE-HERCULES and HAWK. Studies on AN/GSS-1 and Missile Monitor.

d. Gas and Aerosol Filter Material - Evaluation of dry process material. Applied research to obtain improved absorbent for protective applications.

e. Collective Protection for Field Type Shelters - Applied research on field type diffusion shelters. General design studies on diffusional shelters.

f. Tank Collective Protection System - Work on E37R1 Tank Protector and other protection problems on tanks and combat vehicles.

g. Helicopter Pilots' Mask - Development of helicopter pilots' mask.

h. Field Protective Mask - Completion of development of E13 type field mask which will satisfy USCONARC requirements.

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(U) Project Title: CW-BW Protective Material

6. Contract Program in Support of This Project:

- a. (1) Contract Title: Protective Clothing Materials
- (2) Contractor: Harris Research Laboratories
- (3) Scope: Conduct investigative studies of clothing to protect the human body from percutaneous attack from toxic agents
- (4) Date of Initiation: May 1958
- (5) Date of Expiration: May 1959
- (6) Amount Funded to Date: \$10,000
- (7) FY 59 Funding Requirement: \$10,000
- (8) Principal Investigator: Mr. A. Schwartz
- b. (1) Contract Title: Protective Devices
- (2) Contractor: Mine Safety Appliance Company
- (3) Scope: The design and development of protective devices, including E 13 Mask
- (4) Date of Initiation: April 1953
- (5) Date of Expiration: December 1958
- (6) Amount Funded to Date: \$601,350
- (7) FY 59 Funding Requirement: None
- (8) Principal Investigator: Mr. H. Cotabish
- c. (1) Contract Title: Gas Aerosol Filter
- (2) Contractor: Waterbury Companies
- (3) Scope: Design a process for the mass production of gas aerosol and filter elements.
- (4) Date of Initiation: March 1956

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Project Title: CW-BW Protective Materiel

(5) Date of Expiration: December 1958

(6) Amount Funded: \$99,800

(7) FY 1959 Funding Requirements: \$10,000

(8) Principal Investigator: Mr. W.F. Reibold

d. (1) Contract Title: Small Decontaminating Apparatus

(2) Contractor: Walter Kidde Company

(3) Scope: To investigate the development of a small decontaminating apparatus.

(4) Date of Initiation: June 1954

(5) Date of Expiration: December 1958

(6) Amount Funded: \$91,837

(7) FY 1959 Funding Requirements: None

(8) Principal Investigator: Mr. V. Dennis

e. (1) Contract Title: Improved Field Protective Mask

(2) Contractor: Continental Rubber Company

(3) Scope: Development of an improved field protective mask.

(4) Date of Initiation: June 1953

(5) Date of Expiration: December 1958

(6) Amount Funded: \$49,870

(7) FY 1959 Funding Requirements: None

(8) Principal Investigator: Mr. A.C. Erca

f. (1) Contract Title: Permeable Protective Clothing Treatments

(2) Contractor: Food Machinery and Chemical Corporation

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Project Title: CW-BW Protective Materiel

(3) Scope: To develop methods of treating protective clothing which will be self-indicating.

(4) Date of Initiation: September 1957

(5) Date of Expiration: December 1958

(6) Amount Funded: \$88,000

(7) FY 1959 Funding Requirements: None

(8) Principal Investigator: Mr. J. Keefe

g. (1) Contract Title: Research and Development of Protective Devices

(2) Contractor: Mine Safety Appliance Company

(3) Scope: To develop direct color tests for use in G and V alarms

(4) Date of Initiation: May 1958

(5) Date of Expiration: January 1959

(6) Amount Funded: \$80,500

(7) FY 1959 Funding Requirements: \$80,500

(8) Principal Investigator: Mr. J. Lytle

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1. (U) Project Title: Environmental Field Testing
2. (U) Purpose: To fulfill the requirement for comprehensive environmental testing established by AR 705-5 and AR 705-15.
3. (U) Objective: To maintain a comprehensive environmental field test program to evaluate Chemical Corps materiel against objectives outlined in AR 705-15 and to evaluate performance and storage capabilities of Chemical Corps materiel under environmental stress.
4. (U) Funding:

<u>Present</u>	<u>Proposed</u>
\$200M	\$810M
5. (U) Scope: This project includes maintaining test teams at arctic, desert, tropic, and temperate test sites to generate data and evaluate performance and storage capabilities of Chemical Corps materiel under short-term and long-term environmental stress. Approximately 40 items are now under test with new items being added as they become available from the development program.
6. (U) Contract in Support of this Program: None

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1. (U) Project Title: CBR Field Testing
2. (U) Purpose: To provide the essential data for the engineering design, engineering testing, and proof of potential of all Chemical Corps CW and BW munition-agent combinations. This is implemented by a program of field testing of these items conducted by the U. S. Army Chemical Corps Proving Ground.
3. (U) Objective: To test CBR agents, weapons, and defense items under dynamic field test conditions to determine their suitability.
4. (U) Funding:

<u>Present</u>	<u>Proposed</u>
\$1986M	\$5580M
5. Scope: This program includes:
  - a. CW Development Testing - By testing various munitions under representative dynamic conditions, data will be generated to broaden the basis for evaluation of the dissemination of CW agents and the suitability of new munitions for type classification. Data provided under this project serve to quantify our new capability in CW and the ability of our agent-munition systems to circumvent the field protective mask.
  - b. BW Development Testing: By testing various munitions and BW dispensing systems under dynamic conditions, data will be evolved to enhance the technology of BW agent dissemination and provide development and engineering test information leading to type classification of BW munitions. This work will lead to BW offensive capabilities not presently available.
6. (U) Contract Program in Support of This Project: None

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OTHER CONTRACTS

1. ~~(S)~~

- a. Contract Title: A Study Relating to BW Detection
- b. Contractor: National Academy of Sciences
- c. Scope: Endeavor to ascertain, so far as practicable, a fresh and basic approach to the problems inherent in biological agent detection.
- d. Date of Initiation: December 1957
- e. Date of Expiration: March 1959
- f. Amount Funded To Date: \$6,000
- g. FY 1959 Funding Requirement: None
- h. Principal Investigator: Dr. Clem Miller

2. ~~(S)~~

- a. Contract Title: Study and Analysis of the BW R&D Program
- b. Contractor: Booz-Allen Applied Research, Inc.
- c. Scope: Investigation and analysis of the BW R&D program with respect to those areas where BW can make a substantial contribution; an evaluation of current and planned programs in the BW field in light of progress and overall requirements; make as required specific individual appraisals of the overall BW program.
- d. Date of Initiation: February 1957
- e. Date of Expiration: January 1962
- f. Amount Funded to Date: \$477,000
- g. FY 1959 Funding Requirement: \$230,000
- h. Principal Investigator: Project Officer - Mr. Hayward

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3.

- a. Contract Title: Survey of Test Practices
- b. Contractor: General Analysis Corporation
- c. Scope: Conduct a detailed survey of current test practices of Biological Warfare Laboratories, Chemical Warfare Laboratories, and Dugway Proving Ground.
- d. Date of Initiation: September 1958
- e. Date of Expiration: February 1959
- f. Amount Funded To Date: \$57,247
- g. FY 1959 Funding Requirement: None
- h. Principal Investigator: Mr. Paul Homeyer

4.

- a. Contract Title: BW/CW Study
- b. Contractor: University of Pennsylvania
- c. Scope: Contract is divided into two phases, (1) Supported by DOD deals with the feasibility of employing non-lethal BW/CW agents in limited war situations, (2) Supported by the Chemical Corps deals with the communication of R&D information on BW/CW between research and development agencies of the Army Chemical Corps and military planning and using agencies.
- d. Date of Initiation: July 1958
- e. Date of Expiration: June 1959
- f. Amount Funded To Date: \$100,000
- g. FY 1959 Funding Requirement: None
- h. Principal Investigator: Dr. K. Krieger

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1. (U) Project Title: Environmental Field Testing
2. (U) Purpose: To fulfill the requirement for comprehensive environmental testing established by AR 705-5 and AR 705-15.
3. (U) Objective: To maintain a comprehensive environmental field test program to evaluate Chemical Corps materiel against objectives outlined in AR 705-15 and to evaluate performance and storage capabilities of Chemical Corps materiel under environmental stress.
4. (U) Funding:

<u>Present</u>	<u>Proposed</u>
\$200M	\$810M
5. (U) Scope: This project includes maintaining test teams at arctic, desert, tropic, and temperate test sites to generate data and evaluate performance and storage capabilities of Chemical Corps materiel under short-term and long-term environmental stress. Approximately 40 items are now under test with new items being added as they become available from the development program.
6. (U) Contract in Support of this Program: None

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1. (U) Project Title: CBR Field Testing

2. (U) Purpose: To provide the essential data for the engineering design, engineering testing, and proof of potential of all Chemical Corps CW and BW munition-agent combinations. This is implemented by a program of field testing of these items conducted by the U. S. Army Chemical Corps Proving Ground.

3. (U) Objective: To test CBR agents, weapons, and defense items under dynamic field test conditions to determine their suitability.

4. (U) <u>Funding:</u>	<u>Present</u>	<u>Proposed</u>
	\$1986M	\$5580M

5. Scope: This program includes:

a. CW Development Testing - By testing various munitions under representative dynamic conditions, data will be generated to broaden the basis for evaluation of the dissemination of CW agents and the suitability of new munitions for type classification. Data provided under this project serve to quantify our new capability in CW and the ability of our agent-munition systems to circumvent the field protective mask.

b. BW Development Testing: By testing various munitions and BW dispensing systems under dynamic conditions, data will be evolved to enhance the technology of BW agent dissemination and provide development and engineering test information leading to type classification of BW munitions. This work will lead to BW offensive capabilities not presently available.

6. (U) Contract Program in Support of This Project: None

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